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The N. E. L. A. and Legislation

The uncertainty about the attitude of the Washington administration concerning holding companies of all kinds has not yet been removed. The last public expression of opinion from President Wilson was his remark: "We are agreed that holding companies should be prohibited." It is understood that the President has modified this sweeping condemnation, but he has not given so effective a publicity to his altered views as to his original statement. The uncertainty is deepened by the delay over the completion of the administration holding-company bill. The delay is generally supposed to be due to the fact that fuller consideration is being given to this important matter. It ought to be reasonable to expect that no serious steps toward the dissolution of holding companies which are economically justifiable will be taken, but unfortunately it is not safe to conclude that destructive action will be withheld. Certainly some holding companies are justifiable, just as there are others which are indefensible. Business men should take pains to point out to the federal government a distinction which it can fairly draw between the two classes. So far as the electrical industry is concerned, the holding company controlling separate utilities has many advantages for both the public and the corporation. Its abuses are preventable. The National Electric Light Association is so clearly the representative of the companies in vital issues that it could well serve the industry by presenting facts and expressing opinions on this subject for the benefit of members of Congress who have asked for the views of business men. In measures affecting the industry the presentation of statements by authorized representatives before committees of Congress is a proper function of the N. E. L. A. The association should do what it can to preserve the economic advantages of the holding company. It can do this with as clear a recognition of the possibilities of abuse of the holding company as of the possibilities of benefit.

Skin Effect in Conductors

It is well known that in the case of a continuous current flowing steadily along a uniform conducting wire the electric energy is carried over the surface of the wire through the surrounding dielectric medium, but some of the energy in transport sinks into the wire and heats it. The remarkable fact is that this dissipation of energy within the substance of the wire is not greater at the surface than at the center, and, so far as can be determined, it is uniform over the entire cross-section, provided that the difference of temperature between the center and surface of the wire is negligible. However, when an alternating current flows through the wire the effect of the alternating magnetic field is to crowd the current into the surface layers of the wire and to keep the current out of the center. If the wire is of large diameter and the frequency high, the current will penetrate appreciably only to a small depth into the wire or will confine itself to the outside skin. The inside of the wire is mere stuffing, from the electrical point of view, under such conditions, and it would be better if the inside were removed altogether. The effect is also substantially the same whether the wire be solid or stranded. We abstract in our Digest a paper by Prof. E. F. Northrup and Mr. J. R. Carson on skin effects, recently published in the *Journal* of the Franklin Institute. The authors discuss the skin effect in conductors from both the experimental and mathematical standpoints. A mathematical analysis of the subject was made many years ago by Lord Kelvin, but the experimental measurements made in this field have been very few. It has been known that, in the case of an ordinary steel wire, the increase of resistance with alternating currents due to skin effect rises with the current strength up to a certain critical value and then declines, but that is almost all. A great deal of new and valuable experimental information is contained in the paper here considered.

Modern Office-Building Problems

The electrical equipment of a large office building is very well typified in the description of the plant of the new Union Central Life Building in Cincinnati on page 417 of this issue. The problems of the situation center around the fact that there must be installed a complete electrical outfit for several city blocks, spaced vertically instead of horizontally, with all the inconveniences thereby implied. The conduits must be run in the walls instead of underground, the feeders must be erected in the same direction, and the electric railway, sufficient to accommodate the casual needs of a population of a town of several thousand people, must go straight up and down instead of running on a level. To be sure one is not forced to wrestle with municipal politics in its administration, but there are frenzied "kicks" from the populace at any interruption of service. Perhaps the most interesting feature of the building, encompassing from basement to capstone some eight acres of floor area, is the fact that it receives energy from a double-decked generating station equipped with a stack about 550 ft. high, which should certainly insure a sufficient draft. The engines for the main plant, installed on the floor above the boiler room, are compound non-condensing units operated with

superheat and directly connected to generators having an aggregrate rating of 750 kw—more than enough for many a small city. Use is made of three-wire balancers, as befits the distribution system. The peak load is about 530 kw, of which nearly two-thirds is in motors, a proportion which rather upsets the preconceived notions of the layman about building service. The vertical electrical railway is somewhat less than an eighth of a mile long, but it makes up for the deficiency in length by having nineteen tracks all told and running cars on very short headway. The motor equipment rating averages about 25 hp per car, a fact of which those who remember the early electric railways will take notice. The lighting of the community aggregates about 2400 "16-cp equivalents" on the ancient rating. These comparative items give a good idea of the magnitude of the work which has been carried out, though they do not include the many and interesting refinements which engineering skill has brought to bear upon meeting the special requirements of the case. Truly, a modern office building represents an extraordinary structural feat, and its electrical equipment involves a task of no mean order.

Accumulating a Load-Factor

The description of the load-factor of the Southern California Electric Company in this issue is full of suggestion to the central-station manager. In a system so largely supplied with energy from hydroelectric stations a high load-factor is imperative from the standpoint of fixed costs and of labor as well, and the moral to be drawn from the good results here displayed is an obvious one. The load charts are peculiarly instructive as to the admirable effect of increasing the motor load. As between the two charts shown, differing in date by a year, the evening lighting peak is almost unchanged, while the motor load through the day has increased enormously. The winter months would, of course, show a somewhat less favorable load curve owing to overlaps, and yet the situation is very much better than usual. In the various load curves given the singular feature is their uniformity in point of time. Between individual and individual there are probably great diversity-factors, but between community and community these tend to disappear, and hence great care must be exercised to gather such loads as tend to help matters. It is interesting to observe that the highest load-factor was secured in a rural community with a single small city and a good pumping load devoted to irrigation. In fact, in most of the districts considered irrigation load has proved very advantageous. Looking at the results as a whole, it will be seen that an admirable day load has been built up, but with a large loss at and near noon, while the night load shows the usual deficit, although smaller here than is often noted.

In the case described in this issue the greatest difference lies in the times of maximum loads, owing to diversity of uses. This condition enables the system load-factor to be brought to a very unusual figure, while because of judicious exploitation all the component load-factors are good. The greatest problem with all plants lies in the difficulty of obtaining suitable night loads. From 10 p. m. to 8 a. m. is a period during which only the most desperate efforts seem able to make much headway toward business. It would seem possible that something might be done at such times in the way of pumping water into reservoirs for site supply or for irrigation. It would pay many a plant to make special inducements to transfer loads of this sort mainly into the night hours, for the work requires little or no attention at the receiving end and the generating machinery requires about the same supervision in any event. For economic reasons of the plainest kind a reward awaits the man who devises a method for the profitable utilization of energy through the "wee sma' hours." He will get his energy very cheaply and his name will be blessed of central-station managers. Even lacking this, the situation of the Southern California Edison Company is yet one that reflects vast credit on the assiduity of the managers in business-getting.

Protective Reactors

Reactance in alternating-current circuits is well known to be the cause of a depression of power-factor from the desired 100 per cent limit to values that may sometimes fall below 50 per cent. Alternating-current motors of the induction type, running under light load, operate in such a manner as to offer a relatively high inductive reactance, with a correspondingly low power-factor. From the station manager's standpoint, therefore, reactance in consumption circuits is commonly regarded as an enemy to pressure regulation and to energy delivery.

In recent years, however, the growth of large units and of concentration of production in large electric generating stations has enabled the much-abused reactance to be utilized for the purpose not only of making the power-factor very low in the case of an accidental short-circuit but also of cutting down the maximum short-circuit current. It is evident that great advantage and economy are to be derived from generating 100,000 kw in a single station, instead of in, say, ten generating stations of 10,000 kw each, scattered over the district of distribution. But in the event of a heavy short-circuit occurring close to a station the magnitude of the blow coming on the generators would probably be much greater in the case of the concentrated plant than in that of the scattered plant. The rush of current into a heavy short-circuit might be enormous in the concentrated plant, with correspondingly violent destructive effects.

The effect of distance is capable of being simulated electrically by ohms of separation. Whereas, however, the insertion of resistive ohms between two generating units is not only virtually to separate them to a distance but also to waste energy in their electric communication, reactive ohms between the units give the same virtual separation without the corresponding

waste of energy when the units are co-operating. The insertion therefore of, say, a third of an ohm of reactance in each of the three busbars connecting two 6-kv units has the effect of virtually separating them to a considerable distance of ordinary conductor, so that, in the event of a heavy short-circuit coming on one of the units, the other would feel the blow in greatly reduced degree. At the same time, the energy expended wastefully, as heat, in the reactor is much less than that which would accompany the same amount of resistance in the normal co-operative output of the units.

A paper on the subject of protective reactors which we abstract in this week's Digest has recently been presented to the Newcastle Section of the Institution of Electrical Engineers in Great Britain. There is some difference of opinion as to the best location for these reactors with respect to generators, busbars and feeders. The reactors are ordinarily of very simple mechanical construction, being formed of bare copper cable, wrapped helically in two or three open layers around insulating blocks. Nevertheless, they occupy a relatively large space, because they can absorb energy during a short-circuit only protectively, by concentrating magnetic energy cyclically into the neighboring air. It is desirable to keep the number and volume of necessary reactors to reasonably low limits. At first, reactors were inserted merely in the generator mains of a station, between each generator and the busbars, but there is a tendency at the present time to place the reactors in the busbars and in the feeders, leaving the generator connections clear. There can be no doubt that the judicious use of reactance in this manner has already reduced the danger to central-station plants from short-circuits in their immediate neighborhood.

Trust Legislation

To the electrical industry the most important part of the proceedings of the Chamber of Commerce of the United States, which met in Washington last week, was the address by Mr. Guy E. Tripp, abstracted elsewhere in this issue. It is the clearest and most outspoken criticism of the administration policies concerning business that has come publicly from a large interest in the electrical industry. It is not a sweeping or destructive criticism. It recognizes good in the pending legislation. It recommends changes to adapt the legislation more closely to the needs of business. We do not doubt that if time had permitted Mr. Tripp would have elaborated his constructive ideas to greater length. It will be an advantage to the industry if he will do so in the future. Congress has not had so much experience in business as it has had in the regulation of business. Unless it is told, it will not know how laws will affect business. To show that this is so, there may be cited the complete absence of any recognition of the inherent monopolistic character of public utilities in the pending program of legislation. Monopoly is decried, but it is not expressly stated that monopoly of specific trades or industries is the thing that is opposed; nor is it stated, as should be done explicitly or by undeniable inference, that monopoly in a single public utility service in a single community is economically beneficial to the public. There was a time when operators, though knowing that they were economically right in seeking public utility monopoly of this character, feared to express their views publicly. But all that they did not say on this subject has been said effectively since then by the public service commissions appointed by the public to regulate the companies. Now it appears to be necessary to say it again in order that Congress may not legislate unwisely. With this idea in mind, Mr. Tripp draws a distinction between the natural public utility monopoly and the naturally competitive business.

In his discussion of the proposed trade commission Mr. Tripp confines himself to the bill introduced to make effective the purpose of the administration. That is to say, he does not discuss the suggestions for a trade commission with power over industry similar to the power held by the Interstate Commerce Commission over railroads. The trade commission which the administration bill proposes is not much more than an enlargement of the present Bureau of Corporations. That bureau has not been effective as a promoter of commerce. Its activities have been confined to investigations and reports partly of the yellow newspaper style. If the trade commission is not to do more, except in the amount of its activities, than the Bureau of Corporations has done, substantially the same end will be served by letting the Bureau of Corporations remain where it is. The most serious criticism in Mr. Tripp's remarks on the interlocking directorate bill is that the prohibition intended by this law will foster dummy boards of directors. In other words, it will tend in some cases to keep responsible men from positions which they should fill and for the proper occupancy of which they should be held accountable.

With supplemental definitions of the Sherman act which increase the uncertainty for business men and a trade commission without authority to clear the outlook, the present program of the administration does not provide a "help to build up the business of the country on sound and permanent lines." These words, in which President Wilson expressed his early views, should not be lost to sight. The performance should square with the promise. Mr. Tripp regards the anti-holding company bill as "fraught with more danger" than any of the others. The draft of the administration bill on this subject has not been completed. Until it is completed there is only the President's sweeping word against holding companies *in toto* to guide criticism. It appears improbable that so ill-informed an act as a complete prohibition of all holding companies could become a law. But the danger that such legislation may be enacted is imminent until there shall be definite assurance to the contrary. Business men affected cannot safely or wisely assume that the pending legislation will not be inimical to their fair interests. The President's early reassurances to business were sincere. The spirit of them should be kept in the laws.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Tennessee Contractors' Convention at Memphis

The third annual convention of the Tennessee Electrical Contractors' Association was held at Memphis, Feb. 16 and 17. President Ernest Freeman and other officers of the National Electrical Contractors' Association were in attendance during the second day's session. Officers of the Tennessee association were elected as follows: President, Mr. W. C. Tupher, Memphis; secretary, Mr. Joseph A. Fowler, Memphis, and state director in the national association, Mr. H. G. Street, Memphis. The convention closed with a Jovian rejuvenation.

N. E. L. A. Exhibit Arrangements

The Bellevue-Stratford Hotel, Philadelphia, has been selected as the meeting place for the National Electric Light Association convention to be held in that city in June, and it will also be the headquarters for the exhibit of Class D members of the association. The top floor of the hotel is to be used as the exhibit space and will be handsomely decorated in keeping with the appointments of the rooms themselves and with the standards set by previous convention exhibitions. Most of the rooms have 30-ft. ceilings and every window commands a view for miles over the city. Information concerning the exhibit plans, application blanks, etc., will shortly be sent out to prospective exhibitors.

Electric Trucks in New York's Snowstorm

Beginning Saturday morning, Feb. 14, a heavy snowstorm blockaded the streets of New York City, and subsequent falls during the next three days increased the drifts on the city's thoroughfares until vehicular traffic could proceed only with the utmost difficulty. Taxicab companies, for example, refused to send cars out of their garages, and many street-car lines were forced to stop running owing to the clogging of the underground slots with snow and ice. Storage-battery cars transferred from other lines were put on emergency service along some of the more important routes and carried hundreds of passengers who otherwise would have been forced to walk.

While the heavy snow impeded all kinds of vehicles, motor-driven trucks got through the drifts in many instances where horse-drawn wagons were utterly helpless. Particularly good records were made by fleets of electric trucks. Of the fourteen parcel-post delivery wagons (described in these columns Jan. 10) leased by the New York post office, nine were in active service the first day of the storm, and this number was increased to thirteen on the second day. All made their accustomed deliveries and returned to the postal substations without trouble. The New York Edison Company had about 125 electric trucks in operation on both days, and in each instance reported trouble with only three or four. Electric trucks in the service of wholesale grocers, brewers, merchants, etc., experienced varying degrees of difficulty, but despite the severe conditions most made their deliveries, although with greatly reduced battery mileage. Many trucks had gone out without fully charged batteries, and most of the "tow-ins" that occurred were traced to this cause. Altogether electric trucks made enviable records in negotiating the heavy drifts of the storm and furnished the public with a striking demonstration of the dependability of the electric vehicle under the most adverse road and weather conditions.

Western Inspectors Favor Refillable Fuses

At the annual meeting of the Western Association of Electrical Inspectors held in Cincinnati on Jan. 27, 28 and 29 there was much discussion on the subject of the advisability of approving refillable fuses. Finally, at the instance of Mr. Victor T. Tousley, chief electrical inspector for the city of Chicago, a motion was carried by which the association recommended that Rule 68 of the National Electrical Code be so revised as to permit approval of refillable cartridge fuses.

In explaining the motion Mr. Tousley said that he did not think it would be proper for the association to go to the extent of recommending any particular wording or any specific change in the present wording of the rule covering this matter. But the motion is intended to express the fact that there is a desire for a refillable fuse.

Stevens Creek Plant Put Into Operation

Operation of the Stevens Creek plant of the Georgia-Carolina Power Company was inaugurated Feb. 16, energy from this station being transmitted to the city of Augusta, Ga., 9 miles distant. The new development is on the Savannah River north of Augusta. The dam, which is of the ogee type and built of cyclopean masonry, is 2000 ft. long and averages 30 ft. in height. Its maximum height is 47 ft. The power house is designed for an ultimate installation of ten 3125-hp I. P. Morris vertical main units and two 450-hp exciters. At present only five main units and the exciters have been installed. The ultimate output of the station will be 31,000 hp. The capacity of the first installation is 15,600 hp. Adjacent to the power house is a lock 30 ft. wide and 150 ft. long, with a lift of 27 ft.

Banquet of Pittsburgh Section, A. I. E. E.

More than 300 persons attended the annual banquet of the Pittsburgh Section of the American Institute of Electrical Engineers, which was held Feb. 14 at the Fort Pitt Hotel, Pittsburgh, Pa. In his address President Mailloux, the guest of honor, characterized the A. I. E. E. as the "alma mater" of many electrical engineers, who, he said, hold it in grateful affection for the instruction acquired through its activities. Mr. Paul M. Lincoln, Westinghouse Electric & Manufacturing Company, spoke on the subject of "Rates."

Conservation in Electric Railway Relations

At a joint meeting of the Washington Section, American Institute of Electrical Engineers, and the Washington Society of Engineers, Feb. 10, Mr. B. J. Arnold, Chicago, gave an illustrated talk on the subject "Some Applications of the Principles of Conservation to the Readjustment of Relations Between Municipalities and Urban Railways." The speaker discussed conditions in Chicago, San Francisco and Kansas City and explained his plan for the creation of an amortization fund which might be used to build extensions, make repairs, etc., thus increasing the gross revenues of the company without correspondingly adding to its capitalization. In the case of a new electric railway, said Mr. Arnold, no sooner are the cars first run than the equipment becomes "second-hand" and its value goes down to 75 per cent of the initial investment. The New York subway, continued the speaker, has increased the value of surrounding real estate to an amount equal to the cost of building the subway itself. Messrs. Clarence King, Ralph W. Pope and Colonel Harding took part in the discussion.

Co-operation Between Architect and Engineer

Under the auspices of the Architectural League a meeting was held at the league rooms on West Fifty-seventh Street on Feb. 17, to discuss plans for creating and fostering a better spirit of co-operation between architect and engineer in the construction of city buildings, particularly as regards the requirements of scientific illumination and the needs of the tenants for various electrical service within the building.

Invitations to participate in the discussion were extended to representatives of the Architectural League, the Society of Mural Painters, the National Sculpture Society, the Society for Electrical Development, the Jovian Order, the Illuminating Engineering Society and the American Museum of Safety. The proceedings were in the nature of a preliminary conversation, and the chairman, Mr. Cass Gilbert, was careful to point out that no definite action arising out of the discussion could be taken at once by the league, but that resolutions passed at the meeting could be placed before the directors for their careful attention.

Dr. William H. Tolman, of the Museum of Safety, made a request for the co-operation of Architectural League members as jurors in passing upon designs of medals awarded by his association for the successful housing of industrial plants and those employed in the industries.

Mr. J. M. Wakeman, representing the Society for Electrical Development, spoke of the need for closer harmony between architect and electrical engineer in making provision for electrical service in modern buildings, not only as regards their lighting requirements but also in relation to all the other uses of electricity.

Mr. L. B. Marks, on behalf of the Illuminating Engineering Society, stated that this society exists only for the purpose of co-operation and declared that it would be pleased to help in carrying these co-operative plans to a point of definite accomplishment. He said that engineers are sometimes ignorant of the technique of architecture, but it is also true that they possessed valuable experience on correct and incorrect methods of illumination which could be of the greatest assistance to the architects.

Mr. J. R. Strong, who spoke for the members of the Jovian Order, referred to the confusion which exists through duplication and multiplication of authority in passing upon the electrical equipment of buildings. The right to say whether such and such a wiring plan or service equipment is adequate and safe or inadequate and unsafe should be vested in a single authority, and anything that can be done in straightening this matter out will undoubtedly redound to the great advantage of the electrical interests involved.

The most interesting feature of the evening's proceedings was a lecture by Mr. M. Luckiesh, of the physical laboratory of the National Quality Division of the General Electric Company, Cleveland. With a somewhat elaborate lighting equipment, over which the lecturer had exact control as to quantity, color and direction, Mr. Luckiesh displayed a number of different sculptural exhibits, colored prints and oil paintings, and illustrated in a very striking manner the wide variation in effect which can be produced upon a single exhibit by possible changes in the light source.

Business Training for the Engineer

At the joint meeting of the Philadelphia sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers held in Philadelphia last week, Mr. Henry Hess gave an original and striking analysis of the causes of complaint of the engineer's alleged lack of business ability.

Mr. Hess stated that the trouble lies in a misconception of what constitutes an engineer. Broadly, an engineer is one who brings about a desired end by the use of the materials at hand or which can be brought to hand. The definition embraces almost every human activity; it is indorsed by the community in general as is evidenced by the current phrase "engineering a deal." It appears, however, that the colleges in particular have construed the term "engineer" in a narrow sense, giving it the meaning "designer" rather than its broad significance. Thus there are courses in civil engineering, in electrical engineering, in mechanical engineering, with occasional reference to some possible connection with the practical conduct of affairs. Almost invariably, however, this is in schools of a rather elementary grade and not in the high-class technical schools. Once get the engineering colleges to realize that their function is to teach more than mere design and there will be secure reliance on the self-sacrificing body of earnest men known as the faculties to teach real engineering as well as they now teach design.

Young men will not be turned out of college fully fledged or spring full-panoplied from their alma mater as did Athena from the head of Zeus. In fact, a further course in the actual business of life is absolutely necessary. No college can give the needful training; in fact, nothing can but a hard rub against the business man who demands a dollar plus of real value for a dollar in pay.

To illustrate his meaning, Mr. Hess cited a case from his own experience. He had associated with him at one time a graduate of a prominent German technical college. When asked to design a simple pneumatic crane, an almost completed pencil design of beautifully precise execution was produced in two days' time, including a set of triple-expansion hoisting cylinders of high efficiency. A question as to the kind of efficiency included in the calculations was met with scorn. A request for a calculation in marks and pfennigs of making fifty lifts per day, based on initial cost and probable relegation to the scrap heap in ten years as compared with a crude, single-cylinder affair having no cut-off, resulted in the resignation of the graduate. He would not be a party to the making of so criminally inefficient a

design merely to satisfy a non-professional, brutally commercial instinct. This young man was a "school engineer"; he dealt and had been taught to deal only with part of the materials at hand. No matter how efficiently he might deal with that part, he never could be a successful engineer, although he might achieve excellent success as a designer.

The logical process of the real engineer are these: He first inquires into the ultimate purpose to be served; then how this may be done at the least possible cost, including all factors. In the case of the hoist there are the costs of building it, of finishing it with operating labor, of supplying it with compressed air, of keeping it in repair, and finally of discarding it at the probable end of its useful life. In the last analysis, it is the "dollar" efficiency that marks the engineer, as "mechanical" efficiency marks the designer.

American Society for Fire Prevention

The American Society for Fire Prevention, organized in New York City on Feb. 11, has as its main object the uniform codification of statutes, ordinances and regulations pertaining to building construction. Among the greatest obstacles to fire prevention at the present time are the chaotic condition of building regulations and the conflicting authority of various departments enforcing these requirements.

The new society invites the advice and co-operation of all who are interested in its objects, and desires data and suggestions which may increase the effectiveness of its work. The services and records of the society are offered to all without charge. The organization is supported by voluntary contributions from its members.

Among the other objects of the society, it purposes to compile detailed information on fireproof materials and construction; to appear before legislative, civic and other bodies in advocacy of its objects; to inspect buildings and conduct tests on safety devices; to investigate the causes of conflagrations and recommend preventive measures for similar catastrophes, and to prosecute those responsible for the non-enforcement of safety methods.

At the organization meeting nine vice-presidents, a secretary, treasurer, director of safety and an advisory board of eight members were elected. The president will be chosen later. The offices of the society are at 51 Chambers Street, New York, and Mr. Bernard Glaser is secretary.

Applications of Electricity in Mines

The American Institute of Mining Engineers, which met in New York City, Feb. 16 to 19, devoted its session of Tuesday afternoon to papers and discussions relating to applications of electricity in mines. Mr. H. H. Clark, Chicago, read a paper on "Safeguarding the Use of Electricity in Mines," and Mr. C. M. Means, Pittsburgh, Pa., presented the related subject, "The Safety of Underground Electrical Installations." Mr. H. W. Rogers discussed the equipment of motor-driven excavators, and Mr. Sanford B. Belden, Columbus, Ohio, contributed a paper on "Recent Developments in the Design of Electric Locomotives and Coal-Cutting Machines," which was read by Mr. R. R. Dunlop. Mr. Charles Legrand's paper on "Electric Traction in Mines" was read by title in the author's absence. Mr. S. LeFevre spoke on operating costs of electric mine equipment at Mineville, N. Y. Messrs. W. Kelly and F. H. Armstong described installations in the Penn and Republic mines in Michigan. Mr. W. L. Saunders closed the program with a paper on electric-drill performances. Abstracts of the papers and discussions will be presented later in these columns.

Electrical Supply Jobbers' Meeting

By Telegraph

The Electrical Supply Jobbers' Association met at the Hotel Raleigh, Washington, on Tuesday and Wednesday of this week. Approximately 150 jobbers were in attendance, and half that number of manufacturers looked on from without. Two long sessions were held on Tuesday and three sessions on Wednesday. All were conducted behind closed doors except the session on Wednesday night, at which Representative Oscar W. Underwood, of Birmingham, Ala., and Mr. J. E. Latta, of the Underwriters' Laboratories, spoke. To that session the manufacturers were invited.

The sessions on Tuesday were given over to routine matters such as reports of various standing committees and the appointment of new committees. At the meeting of the board of directors on that day Mr. Franklin Overbagh was re-elected secretary-treasurer, and Mr. T. M. Debevoise counsel, these two being the only officers of the association.

On Tuesday night the Jovian Order held a rejuvenation in the ballroom of the Hotel Raleigh at which forty men joined the ranks of those who pull all together all the time for everything electrical. Among those initiated were Mr. Clarence P. King and Mr. W. F. Ham, president and vice-president respectively of the Washington Railway & Electric Company. Mr. E. S. Marlow, of the Potomac Electric Power Company, was chairman of the rejuvenation committee. The ceremonies were followed by a Dutch supper and cabaret show. About 400 Jovians were in attendance. Speeches were made in turn by Reigning Jupiter W. N. Matthews and Past-Jupiters F. E. Watts, Oscar Turner, W. E. Robertson and T. Bibber.

At the session on Wednesday morning, on the suggestion of Mr. W. E. Robertson, the Electrical Supply Jobbers' Association voted to apply for membership in the Chamber of Commerce of the United States. Mr. Robertson, who attended the meeting of the Chamber of Commerce held in Washington last week, told of the advantages to be gained from membership in that body. He urged the jobbers as an organization to take part in the work of proper representation of business interests and gave in abstract the discussion on the topics of interest to the jobbing trade which took place at that meeting.

Plans for Future Meetings

At the morning session it was also decided to alter the date of the Pacific Coast meeting from 1915 to 1916. The next meeting of the association will be held in May, 1914, at French Lick Springs, Ind., if accommodations can be secured at that time, and if not at the Hotel Chalfonte, Atlantic City. A meeting will also be held at Birmingham, Ala., in October or November, 1914.

At the session on Wednesday afternoon Mr. W. E. Robertson outlined the present status of the Society for Electrical Development, showing how loyally the jobbers' association body had contributed to the co-operative movement and intimating that if the other great bodies, notably the central stations of the country, had supported the society as liberally as had the jobbers it would long ago have been actively engaged in the work for which it was formed.

Mr. H. R. Brand, of New York, addressed the meet-

ing, soliciting its aid in the formation of a society for the development of business standards and control. Such a society, which is in process of formation, has for its object the education of the business man as to the most efficient and advanced methods of doing business. Specialists will work continuously on bookkeeping, filing, billing, shipping, credit systems, etc., compiling data, conducting tests and arranging exhibits for the information and enlightenment of members.

Politics and Business

Owing to the efforts of Mr. Oscar Turner, of Birmingham, Representative Underwood of Alabama, the Democratic leader of the House, was secured as the chief speaker for the session on Wednesday night. Representative Underwood spoke on the topic "Politics and Its Relation to Business." The burden of his address was that the business interests should assert themelves in obtaining proper legislation. He contended that the American people will deal justly if they know the facts, and that it is incumbent on the business interests to see that the people have the facts and have them correctly. Otherwise misinformation will be supplied by the demagogue, and if confiscation and destruction follow the business men of the country have only themselves to blame. Proper publicity and an honest purpose to do what is right were the remedies suggested.

Mr. J. E. Latta, of the Underwriters' Laboratories, made the concluding address of the meeting. His topic was "The Education of the Public in the Use of Standard Electric Wiring Materials." The time when electric service was an experiment, he said, has passed. The property owner now knows that the wiring in his building will be needed as long as will the walls themselves. Why, then, should the installation of flimsy, unstable wiring continue to be so common? Why is it that it is still easy to find a market for sub-standard wiring materials? It has been asserted that the cheap contractor is largely to blame. That he is wholly blameless none would deny. Some maintain that the zeal of the central-station manager for new business likewise contributes to the disorder; but Mr. Latta cited instances where the lighting company, without any local ordinance to demand it, refused to connect service to any building in which the wiring had not been inspected and been found to comply with the specifications of the National Electrical Code. The real cause of the trouble, he stated, is the ignorance of the public as to what constitutes standard electrical work, and the real remedy is to be found in the education of the public in this matter.

The time will probably never come when even the most intelligent layman will be able to distinguish satisfactorily between the better and the less desirable grades of electrical goods. He will probably always have to depend largely upon some other authority than his own judgment. The greater his confidence in a properly constituted authority the better. The thing most needed, therefore, is a more wholesome and general appreciation of the National Electrical Code.

Formulation of Code Rules

Although the code falls short of perfection, Mr. Latta intimated that lack of confidence in it arises from ignorance as to how its rules are made and revised. He said that the committee in charge of revising the code has on it representatives of practically every branch of the electrical industry. Suggested changes may be submitted by anybody and are passed upon by the committee, whose recommendations are reported to an open meeting. It is there that the final adoption or rejection of any proposed amendment occurs, and anyone who so desires may attend, join in the discussion and vote. In the estimation of the speaker, there could be no more satisfactory way of formulating a set of rules, and yet he said the opinion among even well-informed electrical people is that the code represents the findings of some autocratic body with power to impose its wishes upon a helpless public. He suggested that the jobbers through their advertising and sales men should help to make the nature of the code more popularly known, and thus render the road rougher for the pirate dealer in electrical supplies, the dealer whose principal claim to consideration is the fact that he can undersell his competitors, the fellow who is always ready to push the sale of sub-standard materials.

Mr. Latta told of a town where sub-standard wiring and the use of nondescript, hazardous fittings was for years the rule. Finally there came an electrical contractor who told the public, in bold-faced type in the daily newspapers, what standard wiring meant. As a result the contractor now has a large share of the wiring business in that town, and the first thing that his principal competitor does when a prospective customer enters his place of business is to assure him that he sells only approved materials. Ability to take orders for cheap goods, the speaker contended, is not salesmanship.

The Underwriters' Laboratories' Label Service

Outlining the work of the Underwriters' Laboratories along electrical lines, Mr. Latta said he had met salesmen who were very properly making the fact that their goods were on the approved list a strong argument for consideration with any prospective customer. Yet these salesmen thought that when any given product of any particular manufacturer had been admitted to the Laboratories' label service the manufacturer was entitled to apply labels to any unit in this class of products which he might offer for sale. The label service, however, amounts to continuous supervision of the manufacturers' goods at the factory, and, as far as is practicable, this supervision is reinforced by following up the behavior of the labeled appliances or materials in the field. In the case of rubber-covered wire, for example, the Laboratories' inspector at the factory actually tests enough of the factory output to convince him that the coils to which labels are to be applied are standard, and then there is a very complete field follow-up system. From time to time representatives in various parts of the country purchase coils of wire from the stocks of local dealers and send them to the Laboratories for examination and test. Moreover, there has lately been adopted the practice of sending out to every electrical inspector who will use them cardboard tags for mailing samples of wire of doubtful quality to the Laboratories. The inspector who finds wire that seems to him to be substandard material uses this tag to forward a 2-ft. sample of it to the Laboratories, and without any charge whatsoever gets a prompt report of the result of the Laboratories' test on the samples submitted.

Mr. Latta also explained the demerit system as it is employed in the label service on rubber-covered wire, which scheme has also been extended to apply to rigid conduits.

The Underwriters' Laboratories, he said, are desirous of having the public know intimately their work. The Laboratories' natural field, so far as the electrical industry is concerned, is the examination of materials to see that they conform to the requirements of the code, but no opportunity is lost to educate inspection departments and the public to require standard materials. He urged unified effort to continue the campaign until even in the hamlet most remote from the vigilance of the electrical inspector there shall be no thought of using wiring materials that are not up to the standards prescribed by the National Electrical Code.

Policy of Washington Administration on Water-Power Development

President Wilson and the Cabinet devoted almost the whole of the session on Feb. 17 to a discussion of water-powers. It is understood that Secretary Lane of the Interior Department and Secretary Garrison of the War Department are to draft new bills under which water-power resources may be developed.

In accordance with his message to Congress of Dec. 2, it is understood that the President is anxious that there shall be a reconciliation of the differences which have existed between the advocates of "states' rights" and "federal control," and that opportunity shall be given to private capital to develop water-power resources for the benefit of the people if such opportunity can be created without at the same time creating monopolies.

The bills of Secretary Lane and Secretary Garrison are to be based upon the following:

(1) Permits shall be granted to private capital to establish water-power plants on navigable streams to run for, say, fifty years.

(2) At the end of the permit period the plant and the right to operate are to revert to the federal government.

It is the intention of the administration to endeavor to get in touch with private capital to ascertain whether these features could be carried out. In other words, the administration desires to know whether it would be profitable to private capital to build and operate water-power plants for, say, fifty years on such terms. Before drafting their bills in final form Secretary Lane and Secretary Garrison will consult with water-power experts and also with chairmen and members of committees of Congress having to do with water-power matters. Secretary Garrison's bill will deal with water-powers on navigable streams and Secretary Lane will take up the subject of water-powers on public lands.

While the President is understood not to be committed to these features of a proposed bill, it is said that he regards such a permit and reverting plan as a possible solution of the difficulties. The suggested features are tentative and much will depend on what private capital has to say. It is understood that the proposed bill will contain a clause giving to the states in which they are located the plants and the rights to operate them at the end of the suggested fifty-year period.

Water-power matters are expected to occupy a large share of attention of public men in Washington during the remainder of this session of Congress. The office of the chairman of the House committee on commerce is besieged by representatives of capital who desire to know where they stand. A representative of a water-power owner of magnitude in the State of Washington had a conference with Chairman Adamson of that committee last week, during which he said that a great English financial firm desires to go into that field and will furnish unlimited means to build plants if a settlement of the question can be had in Washington on some basis other than the revocable permit plan.

Representative Adamson stated that he has been working for a year, with a sub-committee, of which he is chairman, of the commerce committee of the House, on a plan to amend the general dam act, and that he hopes to bring in an amendment to that act soon.

It is understood in Washington that an effort will be made to bring out of the rules committee of the House, to which it was referred, a resolution offered by Mr. Rainey on Jan. 28, which, if passed, will give to the committee on commerce the power to inquire into the act of Congress granting to the Keokuk & Hamilton Water Power Company the right to construct a dam across the Mississippi River at Keokuk, Ia. This franchise was assigned to the Mississippi River Power Company, and the preamble of the resolution charges that the dam which has been constructed across the river is a hindrance to navigation; that steamboats proceeding up the river are compelled to await the pleasure of the company operating the dam and are sometimes compelled to wait for hours; that the power company is permitted to store water in the night-time in the pool, thereby rendering navigation unsafe and often impossible; that the power company is buying electric-light plants in Illinois, Missouri and Iowa, paying therefor in many cases much more than said properties are worth; that the power company is furnishing poor service at excessive compensation; that a bridge has been built across the river in violation of law and that there has been no compensation provided for the valuable privileges granted by the act.

Trust Legislation, Retail Prices and Patents

The principal subject of discussion at the second annual meeting of the Chamber of Commerce of the United States, held in Washington last week, was the pending anti-trust legislation. Other subjects discussed that are of interest to the electrical industry were the maintenance of retail prices and patents. The latter subject was taken up in a report of a committee. An account of part of the proceedings was published in last week's issue. The article published herewith, containing other proceedings of the convention, includes an abstract of an address by Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, who discussed the bills now under consideration by Congress under the program of the administration.

Address of Mr. Tripp

Mr. Tripp said that, whether it is economically sound or not, the public has the belief that practically all business should be roughly divided into two classes, the one comprising the natural monopolies of public necessities—in other words, public utilities—the other comprising the naturally competitive private business undertakings. Personally, Mr. Tripp finds no fault with such a division, but manifestly these two distinct classes require different legislative treatments. That public utilities should be regulated and not given the free hand that naturally competitive business requires is sound doctrine, but only when such regulation carries with it an obligation to protect such utilities against the menaces which confront competitive business.

Almost nothing has remained unthought of in the way of regulation and restriction, and the cheerfulness with which regulatory burdens have been heaped upon public utilities is discouraging when it is remembered that hardly a single voluntary act for protection has been heard of. Public utilities should be protected against competition, inadequate rates, demands for excessive service, unreasonable and unjust damage claims, federal regulations superimposed upon state regulations and, most important of all, against oppressive demands of labor. Under present conditions, the mere threat of a labor strike on a railroad is sufficient almost automatically to produce an increase in wages or cause railway managers to relinquish their right to enforce discipline in the interest of the safety of the public and economy of operation, as instanced by the recent strike on the Delaware & Hudson road. The best evidence that legislators have abandoned their campaign of punishment and have become sincerely desir-

ous of doing the fair thing by public utilities will be shown when someone has the courage to introduce a bill intended to prohibit effectually strikes and lockouts on railroads.

While railroads and other public utilities need special legislation for both regulation and protection, Mr. Tripp added that a naturally competitive business (like that in which he is engaged) stands on an entirely different basis and, if competitive conditions are maintained for it, as he believes they should be, neither regulation nor protection of the character mentioned has any place in its dealings with the government. If one cannot manufacture his goods and sell them as cheaply as his competitor can, he must eventually fail, and, if his employees force him to the issue, he can shut up his shop and both he and his employees will be out of income for a longer or shorter period, but the general public welfare is not vitally affected.

A great deal of the proposed legislation at Washington is directed toward creating or maintaining conditions which, in the mind of the legislators, will tend to insure competition among this class of industries, which are to be distinguished from public utilities. In so far as these measures will be effective in the direction of securing sane competition Mr. Tripp believes they are wise.

Monopoly is not in itself objectionable; in fact, it is often the most effective way of dealing with industrial affairs. In Germany it is fostered and protected by the government to a large extent, with the result that the commercial supremacy of that country in the markets of the world has been established within a comparatively few years of the most rapid business growth perhaps that has ever been seen. But Mr. Tripp believes that our political institutions and the temper of our people are not adapted to monopolistic methods that are in restraint of trade, and that fair competition in business will make a more contented public, a more secure government, and in the end give greater protection to property. Therefore, he is in favor of all fair and reasonable legislation sustaining that theory.

Fair or sane competition is hard to define. Free competition is not sane competition. The biggest business in the country was founded almost entirely upon the principle of free competition, namely, that of making prices what and when you will and taking all the business from your competitor that you can. If this business was a monopoly, it grew to be so without the aid of interlocking directorates or the alleged money trust; it became a monopoly simply by the practices of free competition. Therefore, in considering the various business measures now pending, particular attention should be given to the question, Will they, or will they not, assist in securing sane competition, not free competition? First, Are they based upon the right principles? Second, Is it probable that acts can be framed which will sustain these principles without doing more harm than good?

A trade commission seems to Mr. Tripp to be needed in a well-rounded plan of business legislation. No other agency can so well collect information, conduct investigations and determine facts for the guidance of the legislatures and courts, and that in the last analysis is all the power that the bill gives it. No great harm can come from elaborate powers given the commission in the way of getting papers and documents except expense and bother to the corporations. It would be a physical impossibility for it to exercise its full powers in this direction. Mr. Tripp objects to the provision that the commission may from time to time make public such information in such form and to such extent as it may deem necessary. There is danger of telling competitors too much and giving half truths to the public.

In the opinion of Mr. Tripp, the interlocking directorates bill, as at present drawn, will wholly fail in its object and will foster the very thing that it aims to prevent. It will tend to create dummy boards and enable responsible men to exercise as much control as ever without the restraining influence of personal responsibility. It will tend to create one-man power corporations and thus render more unstable the investments of the public. It is based on a mistaken or exaggerated notion of the Machiavellian activity of the interlocking director. Those terrible charts of control through interlocking directors are worse than worthless. As an instance, enough misinformation has been gleaned from them to bring out the statement that the General Electric Company and the Westinghouse Electric & Manufacturing Company are only alleged competitors. That is untrue, said Mr. Tripp. If the whole interlocking directorate bill should be wiped out except the last section, and that should simply provide that the fact of a common director shall be prima facie evidence instead of conclusive that no competition exists between two corporations, it would probably be ample to cover the situation.

A careful reading of the very short and concise paragraphs of the Sherman law definition bill leaves one with a feeling that the definitions are fully as vague as the Sherman act itself, and, instead of improving, it further complicates a situation which had begun to be clarified.

If the prohibition against discrimination in prices in the trade relations bill is intended to create sane instead of free competition, Mr. Tripp thinks it may prove to be a good provision. As to prohibiting the fixing of prices upon the understanding that the purchaser shall not deal in the goods of a competitor, Mr. Tripp does not view that as revolutionary, although it might cause inconvenience to some to adjust themselves to it. On the whole, he thinks it is fair.

Mr. Tripp said that there should be included in this bill a provision such as that recommended in the report of the committee on interstate commerce, as follows: "There ought to be a way in which men in such a venture could submit their plan to the government and inquiry be made as to the legality of such a transaction; and, if the government was of the opinion that competitive conditions would not be substantially impaired, there should be an approval, and in so far as the lawfulness of the exact thing proposed is concerned there should be a decision, and if favorable to the proposal there should be an end to that particular controversy for all time."

Section 13 of this bill permits any person to sue out an injunction against threatened loss or damage and might subject a large company to a multitude of strike suits. It should certainly be amended.

The anti-holding-company bill, Mr. Tripp declared, is fraught with more danger than any other of the business bills recently proposed. It will be impossible to prohibit all holding companies without financial disaster, and just how the good can be separated from the bad in an act of Congress Mr. Tripp said he cannot imagine. Public utility holding companies, for example, are sound in principle, even though some are not so in practice. Practically all large corporations are holding companies to some extent and in many cases they are compelled to be so by the operation of state laws.

In conclusion, Mr. Tripp said he believes that no good results can be obtained through wholesale condemnation, and that he does not fear the principles outlined but does fear the unknown dangers of untried

legislation and should have preferred to see such vital changes tried one at a time. If that cannot be, he hopes the government will finally resolve all doubtfully dangerous provisions on the side of the intimidated and apprehensive business interests.

Large and Small Business

Mr. William C. Redfield, Secretary of Commerce, in his discussion on trust legislation, said that a very small number of the large industrial combinations formed a number of years ago had made a success. The competition of small keenly managed competitors has been effective against large organizations. The internal politics of some of the large industrial combinations have equaled the absurdity of the more public politics of the nation. Mr. Redfield said he doubts if any production engineer to-day would argue that the way to get efficiency of production would be to combine twenty or thirty factories hitherto unrelated. The strength of such a combination is no greater than the strength of its most efficient part. Many plants of combinations have been closed in order to make the efficient plant more efficient. Mr. Redfield also spoke of the point at which production becomes so large as to be no longer economical and declared that unseen objects of cost come into sight the minute production is pressed beyond that point.

Mr. Louis D. Brandeis, of Boston, said that the problem could not be solved unless there was a complete divorcement of the railroads and industry. He declared that a discrimination against the small shipper is going on in the railroad world to-day. It must be remembered that America is working on the problem of democracy and that this problem cannot be solved if the effort is confined to a political democracy. Side by side with that must come the consideration of industrial democracy. Mr. Brandeis asked what better thing the government could do than to extend to the manufacturer the aid and opportunity of knowing about his particular line that it extends to the farmer. Medical science, architecture and almost every branch of engineering make known discoveries and methods that will advance the art. Business men should follow the same policy.

Prof. Henry R. Seager, of Columbia University, said that he was in entire accord with the administration's proposal to create a trade commission but regretted other proposals that in his judgment would prevent that commission from rendering the great service of which it was capable in guiding the policy of the country with reference to industrial combinations. The bill designed to amend the anti-trust act so as to condemn expressly discriminatory price policies and selling contracts and to give private litigants the advantage of evidence collected or convictions obtained in government suits is commendable in purpose. The measure against which Professor Seager particularly protested as unnecessary and harmful is the bill which undertakes not only to make the punishment for violation of the anti-trust act personal, as he agreed it should be, but also to define the terms "every contract combination in the form of trust or otherwise" and "conspiracy in restraint of trade" and the word "monopolize" in conformity with the narrowest and most dogmatic conviction that every departure on the part of business men from unrestrained competition necessarily results in restraint of trade and is therefore to be condemned.

Professor Seager thinks that the distinction between natural monopolies and industrial enterprises such as coal mining and iron and steel manufacturing has been too sharply drawn. It is still an open question economically whether the advantage is not with combination rather than with unregulated competition in some branches of mining and manufacturing. German economists and public men are almost unanimous in approving the combination movement in that country, though admitting that the machinery for regulating the cartels is still inadequate and that a vigorous governmental policy is necessary to prevent producers from taking advantage of consumers. Is it probable that a policy so generally approved in Germany is entirely unsuited to the United States?

Retail Prices

Mr. Joseph E. Davies, Commissioner of Corporations, Department of Commerce, discussed retail prices. The bureau is now engaged in making an exhaustive study of this question from an economic point of view. It is the purpose to make that investigation fair and impartial without preconceived bias, prejudice or judgment. For that reason Mr. Davies expressed no opinion upon the merits of the question at this time. He said, however, that the question is not a simple one. It is most far-reaching in its effects. There are excellent reasons advanced in favor of retail price maintenance and strong arguments urged against it. Its importance is not confined alone to the manufacturers, the wholesalers, the jobbers and the retailers. In the matter of the cost of living it affects very vitally the great body of consumers in the country. In the processes of production from the raw materials to the final consumer it is commonly stated that one of the greatest factors contributing to the high cost of commodities is found in the process of distribution. It is a statement of inexorable fact that no system of distribution that does not ultimately and fundamentally conserve the interests of the great mass of the people will ultimately obtain and that the interests of manufacturer and distributer alike lie in the establishment only of such a system as will conduce to the well-being and advantage of the great body of consumers, for in that alone are there assured lasting profit and advantage to the producer and manufacturer and the retailer.

Dr. Donald Dey, of Dey Brothers & Company, Syracuse, N. Y., in discussing price and maintenance from the retailer's point of view said in part: "We have agreements of hours of labor. May not the merchants without injury to the consumer agree with each other on so reasonable a matter as a fair minimum of price? The legislature will surely find a way to permit an arrangement of sale that will be fair, equitable and just. As a layman it seems incomprehensible to me that a manufacturer and a merchant may not enter into an agreement to buy at a certain price, and to sign a stipulation and agreement as to re-sale. It seems unreasonable to me that merchants must appeal to the government for the privilege of entering into a contract with a manufacturer to buy and sell merchandise according to a mutual arrangement or agreement. I think in a practical way we need have no fear of there not being enough competition between the dry goods merchants of every town or city in this broad land of ours."

Patent Legislation

The report of the committee on patents, trade-marks and copyrights recommended an amendment or correction of the Kahn law to relieve this measure of the provision which has caused concern. It also recommended that Congress enact as soon as possible a law establishing a Court of Patent Appeals, to which cases may be taken by either party to a patent suit from the Circuit Court of Appeals, thus doing away with the existing situation under which the patent may be declared valid and infringed by the Circuit Court of Appeals in one district and held to be invalid in another. The other recommendation of the committee

was that an expert commission be created and empowered to investigate the patent laws and the practice under them, to recommend to Congress such legislation as it may conclude to be necessary to perfect the one and correct any abuses discovered in the other, and that no other patent legislation be enacted until this commission has made its report.

Other Matters

A resolution was passed approving the action of the board of directors in taking a referendum of members on the pending anti-trust legislation. Another resolution provided for the appointment of a separate committee by the president of the organization to investigate the subject of price maintenance in respect to articles sold under trade-marks in its economic, public and business aspects and report conclusions and recommendations to the board of directors.

Mr. William B. Wilson, Secretary of Labor, in an address on Feb. 18, expressed opposition to compulsory arbitration of industrial disputes. He said that the decision under such an arbitration may do an injustice to the employer by giving wages which will absorb his entire capital or it might make the employees little better than serfs.

At the banquet held on the evening of Feb. 19 Secretary of Commerce Redfield described the work of his department. He said that the existing conditions had forced upon the department an inquiry as to the fundamental standards of public service corporations. As things are now the companies are much better informed than the public. Few phases of activity will be more useful than this if the department is permitted by Congress to continue the work which it has begun.

Dr. Carl Rathgen, of Hamburg, Germany, who has been making an investigation of the trust situation in this country for the German government, was also a speaker at the banquet.

Hearings on Anti-Trust Legislation

Hearings have been held in Washington during the last week on the proposed anti-trust legislation of the administration before the committees on interstate and foreign commerce and on the judiciary of the House of Representatives.

The commerce committee has closed its hearings on the two bills before that body, the measures to provide an industrial trade commission and to regulate stock exchanges. Chairman Adamson announced that while no more hearings will be held, for the present at least, the committee will be glad to receive and consider statements from anyone who has anything to say.

A sub-committee has been appointed, with Representative Covington as chairman, to draft an entirely new industrial trade commission bill. The other members are Messrs. Sims, Talcott, Rayburn, Stevens and Esch.

While the sub-committee is drafting a new bill, the judiciary committee will continue its hearings on the other forms of the proposed legislation. The committee desires to hear everyone who has anything to say and will receive statements and briefs from any who desire to submit them. They should be addressed to the chairman of the judiciary committee, Mr. Clayton.

It is stated in Washington that the Senate committees do not expect to hold any hearings on these bills. Senators expect that all of the points that should be brought out will be discussed at the House hearings. In case, however, some point develops in the Senate committees which does not seem entirely clear, Senators may ask for statements from those who are known to have special knowledge on the subject.

Public Service Commission News

Wisconsin Commission

The Wisconsin Railroad Commission has granted the petition of the Mount Horeb Electric Company for an increase in rates. The present revenues were found to be inadequate to take care of interest and depreciation charges. The rates authorized are as follows: Primary rate, 14 cents net for the first thirty hours' use per month of the active connected load; secondary rate, 12 cents net for the next sixty hours' use; excess rate, 9 cents net. In Class A, consisting of residences, etc., 60 per cent of the first 500 watts connected and 33.3 per cent of the excess is to be considered as active. In Class B, consisting of stores, offices, banks, etc., 70 per cent of the first 2.5 kw and 55 per cent of the excess is to be active. In Class C, consisting of churches, industrial establishments, hotels, schools, etc., 55 per cent of the connected load is to be considered as active.

The rates for power service are to consist of a service charge of 75 cents per month per hp of connected load and an energy charge of 5 cents per kw-hr. for the first fifty hours' use per month of the connected load, with an excess rate of 3 cents per kw-hr.

The rates ordered are not so high as petitioned for nor so high as the cost of service would require, but, in the opinion of the commission, the interests of the company in the way of increased lighting business could best be conserved by the schedule prescribed.

Indiana Commission

The Public Service Commission of Indiana, in its long-awaited decision in the Indianapolis street-railway strike arbitration proceedings, took steps to avoid a recurrence of a situation under which the commission might be brought forward again as an arbitration board. In its decision the commission established a new board of arbitration, composed of three men to be appointed by the judge of the United States District Court and the chief justices of the State Supreme and Appellate Courts, to handle all differences that may arise within the three-year period during which the awards of the commission in the Indianapolis street-railway trouble are to be binding. The commission also advised that the 1915 Legislature provide an arbitration board.

Several disputes between the employees and the traction companies in various part of the State remain for the commission to solve. These were taken up by the commission during the strike troubles.

The commission has announced a rule which it declares it will follow in the future in regard to a valuation of utility properties. After a petition for approval of issues of stocks or bonds, if there is doubt as to the position of the company, a valuation will be made. The question arose when the Huntington Light & Fuel Company asked the commission for authority to issue $250,000 bonds to retire stock. City officials of Huntington protested that the value of the plant did not warrant this step, and the commission postponed final disposition of the matter pending a valuation.

Criticism of the new system of uniform accounting has been offered in various Indiana cities, principally because city clerks do not understand the meaning of the law. In many places it is declared that the new system of the commission will increase the annual cost to the city many hundreds of dollars. The commission's reply to these criticisms contains a copy of the section of the law which provides for a system of accounting. In nearly every instance that has come to the attention of the commission the privately owned utilities of the State already have a system of accounting that is far in advance of those of the municipal utilities.

Current News Notes

Extensible Platforms for Subway Stations.—No longer will the guard's familiar cry, "Watch your step!" be heard at stations on curves in the New York subway if the extensible platform device now being experimented with proves successful. At points opposite the car doors there will be mounted under the platforms sliding shelf gratings moved by air cylinders controlled by solenoid valves. These gratings will be extended by the platform attendant to cover the gaps, just before the cars come to a stop, and will be automatically withdrawn again after the train has proceeded a few feet on its journey. A trial equipment is now being installed at the Fourteenth Street station.

* * *

Interchange of Dates for I. E. C. Publicity Meeting and Dinner-Dance.—Announcement has been made of the interchange of the dates of the International Electric Congress publicity meeting and the Congress dinner-dance to be held during the midwinter convention of the American Institute of Electrical Engineers at New York next week. According to the revised program, the publicity meeting will be held in the auditorium of the Engineering Societies Building, New York City, Wednesday evening, Feb. 25, when a number of prominent speakers will tell of plans for the Congress and the San Francisco exposition and of the scenic and electrical features of the trip across the continent. On Thursday evening, Feb. 26, the I. E. C. dinner-dance will be held at the Hotel Biltmore.

* * *

Proposed Amalgamation of Electric Club of Chicago and Chicago Jovian League.—At the regular weekly luncheon of the Chicago Jovian League on Feb. 16 resolutions were adopted favoring the merger of the Chicago Jovian League and the Electric Club of Chicago under the title "The Electric Club (with which is affiliated the Chicago Jovian League)." The resolutions were offered by the board of managers of the league and presented by Statesman H. E. Niesz. It is proposed that the league be discontinued, its members to be admitted to the Electric Club without initiation fee. Mr. A. R. Bone, president of the Electric Club, said that the board of managers of the club had considered the proposal and was in favor of it. At the time of writing, however, the Electric Club as a body had not accepted the Jovians' proposition.

* * *

Illuminating Engineers Guests of a Mail-Order House.—On Feb. 11 the Chicago Section of the Illuminating Engineering Society was tendered a dinner by Sears, Roebuck & Company at the company's plant in Chicago. Following the dinner the guests were invited to inspect the lighting of the various office buildings. During the inspection Mr. S. E. Church, electrical engineer for the company, read a brief paper giving the results of tests made on the different types of lighting employed. Among the most interesting of these figures were those showing the effect of accumulated dirt on direct and indirect lighting units. In one office where deep reflectors and frosted-tip tungsten lamps were used to provide direct illumination the tests showed that in two months the light intensity was reduced by 23.2 per cent because of dirt. In an adjacent office where lighting is accomplished by means of indirect units each containing a single tungsten lamp the deterioration was 22.5 per cent for the same time, a surprising result. In summing up the lighting equipment of the company Mr. Church said that there are in operation on the company's premises 20,600 tungsten lamps, 7782 carbon lamps and 3013 Nernst lamps.

SOCIETY MEETINGS

Rejuvenation in Los Angeles.—The Jovians of Los Angeles, Cal., and vicinity gave a rejuvenation at the Union League Club in that city on Feb. 6. There was a dinner, at which Mr. A. E. Morphy was toastmaster. The event was held under the direction of Mr. J. N. Colkitt, statesman, and Mr. J. G. Pomeroy was the Jupiter of the initiation team.

* * *

New York Electrical Society.—The New York Electrical Society will meet at the new 201st Street generating station of the United Electric Light & Power Company, New York City, Feb. 27, for an inspection of the plant. Addresses will be made by Mr. Frank W. Smith, vice-president of the company, and Mr. H. W. Leech, electrical superintendent.

* * *

St. Louis Section, A. I. E. E.—At a meeting of the St. Louis Section, American Institute of Electrical Engineers, Feb. 11, Mr. S. N. Clarkson, power engineer for the Union Electric Light & Power Company, St. Louis, presented a paper on "Some Features of High-Tension Direct-Current Long-Distance Transmission," describing the Thury constant-current system used in Europe.

* * *

Minnesota Convention Next Month.—The next annual convention of the Minnesota Electrical Association will be held at the Hotel Radisson, Minneapolis, on March 18, 19 and 20. The president of the association elected at last year's convention was Mr. Eugene Holcomb, but he has since left the State and the executive committee has recently elected as president Mr. P. T. Glidden, manager of the Consumers' Power Company, of St. Paul, who will fill out the unexpired term of Mr. Holcomb. Mr. Fred A. Otto, of the St. Paul Gas Light Company, is the secretary and treasurer of the association. Every effort is being made to arrange for a good convention.

* * *

Yale A. I. E. E.—Mr. Charles R. Underhill, electrical engineer of the Acme Wire Company, New Haven, Conn., delivered an experimental lecture on "Electromagnets" before the Yale University Branch of the American Institute of Electrical Engineers on the evening of Feb. 11. At the request of Prof. Charles F. Scott, Mr. Underhill repeated the lecture before the senior class on the afternoon of Feb. 12. The lecture covered chiefly the effects of magnetic leakage in plunger electromagnets, and Mr. Underhill showed how the ordinary laws of traction, as usually given in textbooks, must be modified on account of leakage, so that the traction may be accurately predetermined.

* * *

Pittsburgh Section, Association of Iron and Steel Electrical Engineers.—At the Feb. 7 meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers Mr. E. M. Hewlett, General Electric Company, gave an illustrated lecture on the control apparatus of the Panama Canal locks. Motion pictures were shown of the complete equipment in operation. Conditions peculiar to the Canal Zone were described which made it necessary to employ noncorrosive alloys, mica insulation and non-hygroscopic insulating materials on all of the equipment installed. The speaker pointed out how similar remote-indicating apparatus may be employed on gas and water systems to indicate the position of valves. Motion pictures were also shown of the Butte Copper Mines, Anaconda Smelters and the Butte, Anaconda & Pacific Railway system, which is the first steam railroad to be electrified with 2400-volt direct current.

Union Central Life Building, Cincinnati

Electrical features, generating equipment, distribution systems, interior illumination and exterior ornamental lighting of a new thirty-two-story office structure

FEW office buildings in this country outside of New York City and Chicago are as elaborate in exterior and interior details as the new thirty-two-story Union Central Life Insurance Building recently completed at Cincinnati, Ohio. The illumination effects and the electric generating plant in the sub-basement are in keeping with the handsome structural features. The building measures 150 ft. long by 100 ft. wide up to the nineteenth floor. Above this it takes the form of a tower having a cross-sectional area of 8000 sq. ft. and culminating in a pyramidal cap 537 ft. above the level of Baker Street.

Granite and terra cotta are used exclusively for the outer walls. The exterior of the pyramidal-shaped cap is covered with rough tile into which goldleaf has been baked to give it a glistening appearance in the sun. Surmounting the top of the tower is a wrought-iron grill cage which serves as an outlet for smoke from the furnaces in the boiler room. The corridor on the main floor, the library and the executive offices of the insurance company's officials are very elaborately decorated with groined arches, goldleaf, tan marble and ornamental electric fixtures. The general color combination throughout the building is tan and gold.

The second and third floors of the building will be occupied by the Cincinnati Chamber of Commerce, while the floors from the eleventh to the eighteenth

FIG. 1—MAIN CORRIDOR, SHOWING BRACKET FIXTURES

inclusive will be used by the Union Central Life Insurance Company. The remainder of the building will be leased to office tenants.

Boiler-Room Equipment

Electric service for the building is supplied from a generating plant in the sub-basement. On a level below this, however, are installed four Heine boilers, each having 10,000 sq. ft. of heating surface, which supply steam for the generating equipment and for heating the building. Two of these boilers are arranged in a battery and the remaining two are separate units. Each is set on wrought-iron supports independent of the brick setting and is equipped with Roney stokers having

FIG. 2—TYPICAL OFFICE-FLOOR CORRIDOR LIGHTING

removable fuel plates. Each grate has an area of 200 sq. ft. and is designed to burn a low grade of bituminous coal without smoke when 30 lb. of fuel is being consumed per square foot of grate surface. Two vertical, double-cylinder, single-action engines, one of which is normally held in reserve, drive the stoker apparatus.

Feed water is circulated through a Reilly multicoil heater before being delivered to the boilers. All of the water required for 800 hp in boilers can be heated in this one apparatus within 2 deg. to 5 deg. Fahr. of the steam entering the heater. Four feed-water pumps are installed, two of which are compound-duplex pumps and the remainder simple-duplex. The compound pumps are capable of delivering 80 gal. of water per minute at a piston speed of 30 ft. per minute, and the simple pumps, which are used at night and on Sundays, are capable of delivering 20 gal. of water at a piston speed of 22 ft. per minute.

Smoke from the boilers is led up through a single steel stack which runs up the south wall of the building to the twenty-first floor, where an offset connects it with a stack extending up through the central portion of the tower to the grating at the apex. The stack is supported at alternate floors and is provided with extension joints consisting of slip collars and stuffing boxes below each support. The lower 100 ft. of the stack is made of

0.375-in. riveted steel, while the upper portion is of 0.25-in. stock. For a distance of 30 ft. above the grates the stack is lined with firebrick, and from the twenty-first floor to the top with 2 in. of "vitribestos."

Coal is delivered at the rear of the building on the street level and is dumped through manholes into large concrete storage bins. Three 1-ton coal cars equipped

FIG. 3—ORNAMENTAL FIXTURES IN EXECUTIVE OFFICE

with ball bearings convey the coal from the storage bunkers into the firing room, where it is shoveled by hand into the stoker hoppers. The furnaces are provided with doors so that they may be fired by hand in emergencies. Two flat-topped ash cars, 33 in. wide and 60 in. long, are used to convey the ashes from beneath the grates to storage bins and to a telescoping sidewalk lift.

Electrical Generating Equipment

Three generators are installed in the engine room. Two of these are 300-kw, 250-volt direct-current machines and are directly connected to tandem-compound engines, manufactured by Hooven, Owen & Rentschler, of Hamilton, Ohio. The other unit, which is rated at 150 kw, is driven by a non-condensing simple horizontal engine of the same make. All of the generators were made by the Triumph Electric Company, of Cincinnati, and operate at 150 r.p.m., supplying energy to individual buses. The generators are over-compounded 5 per cent and are connected so that they will share the load in proportion to their respective ratings.

As the electric lamps in the building are rated at 120 volts and the motors at 240 volts, two 15-kw differentially wound balancer sets are connected permanently across the generator terminals to provide for three-wire distribution. When the generator is started up the balancer set connected to it is therefore brought gradually up to speed with it.

The switchboard consists of ten panels, three of which control the generators, one is the main power panel, two are distributing panels for the lighting circuits, two are for distributing energy to motors, one is for controlling the balancer sets, and the last is held as a spare. Instead of extending the panels to the floor, the intervening space is filled with a glazed tile wall which forms a partial support for the switchboard. As arranged at present, the machine panels are provided with duplicate buses and three-blade double-throw switches which may be used to connect either generator and its balancer set onto either bus. Motors and lamps are ordinarily fed from separate buses, but it is possible to tie the buses together and to operate the plant as a unit.

A metal grill is constructed around the ends and back of the switchboard, allowing sufficient space for inspection of the rear of the board. As all of the feeder cables are carried out at the top of the switchboard, a sheet-metal pull box, supported from the ceiling and extending the entire length of the board, is installed, so that new cables may be pulled in or old ones inspected. The interior of the box is accessible from the back through a hinged door. This method of conducting the cables to the switchboard makes a more sightly installation than if the box were not used, and also affords means of grouping the cables so that they are suitably arranged for connection to their respective panels.

In the generating room is a 14-in. by 10-in. vacuum pump which operates at 200 r.p.m. and is connected by a silent-chain drive to an 11-hp Allis-Chalmers motor which runs at 925 r.p.m. This pump furnishes the suction for the cleaning system used in the building. Constant vacuum is maintained by an electric regulator which automatically starts and stops the pump motor.

Motor-Driven Ventilating Apparatus

The boiler and generating rooms are provided with both induced and exhaust ventilators, as the superheat maintained in the steam would otherwise make the basement rooms extremely hot. Induced draft for the boiler-room ventilation is supplied by a 42-in. fan driven by a 7.5-hp motor, while that for the Chamber of Commerce is furnished by a 66-in. fan driven by a 10-hp motor. A 15-hp motor drives the boiler and generating room exhaust fan, which is 66 in. in diameter.

Air supplied to the Chamber of Commerce rooms is washed and tempered before being delivered. A set of coils having 2100 sq. ft. of heating surface tempers the air, and an air-washer operated on the spray system

FIG. 4—CHAMBER OF COMMERCE, SHOWING CEILING FIXTURES AND BULLETIN-BOARD LIGHTING

removes impurities such as dust. Water for spraying the air is supplied by a motor-driven centrifugal pump.

System of Electrical Distribution

There are two feeder riser shafts in the building—one extending to the top of the structure, and the other only to the eighteenth floor as shown in the accompanying diagram. In the latter shaft are four three-wire circuits supplying energy to as many sub-feeders connected with

about half of the distributing panels below the nineteenth floor. Two of the sub-feeders supply five floors each, and the other two feed two and three floors respectively.

The high-rise shaft contains five three-wire feeder circuits, most of which deliver energy to sub-feeders supplying five floors each. Two special feeders run to the twenty-seventh and thirty-first floors respectively, to supply energy for exterior ornamental lamps. In the two shafts taken together there are one No. 000, two No. 0000, three 300,000-circ. mil, five 400,000-circ. mil and one 500,000-circ. mil three-wire circuits.

The feeders are supported at every floor by Russel & Stoll cable supports. In the riser shafts at intervals of approximately 35 ft. iron cabinets are installed which serve as additional supports for the conduits and cables passing through them. The riser cables feeding both motor and lamp circuits are insulated with varnished cambric and are protected against mechanical injury by iron conduit. On each floor near the riser shafts are sheet-steel distributing cabinets 0.0125 in. thick, on each side of which are wiring compartments which facilitate making connections with the distributing panels. From the distributing panels to the motor and lamp outlets two-wire circuits are employed. The distributing panels were manufactured by the Frank Adam Electric Company, of St. Louis.

Motors which are used in the building for other than elevator service receive energy from the distributing panels just described. Knife switches are placed on panels near each motor. No circuit-breakers are used on the individual motor circuits as the fuses in the distributing boxes are depended on for protection. Four express-service elevators run to the twenty-eighth floor and eight local cars run up to the seventeenth floor. In addition to these there are two dumb-waiter elevators and five freight elevators. Geared overhead-traction-type elevator motors, having an aggregate rating of 480 hp, are located on the eighteenth and thirty-first floors. Energy for these motors is supplied through special feeders—two 700,000-circ. mil circuits delivering

FIG. 5—LIGHTING ARRANGEMENT OF TYPICAL TENANT'S OFFICE

energy for the low-rise elevators and two 400,000-circ. mil circuits for the high-rise cars.

All wires supplying energy for office lighting are run in conduit from the distributing cabinets along the ceiling to their respective rooms and thence down the walls to switches. Each conduit entering an outlet switch or distributing box is provided with a coupling about 1 ft. from the box so that in case it is necessary to move the box it can be done by replacing the short piece of conduit by another of different length. Knife switches are used on all lighting circuits carrying 15 amp or over.

Interior Illumination

Several different types of electric fixtures are employed in this building. The main corridor is lighted

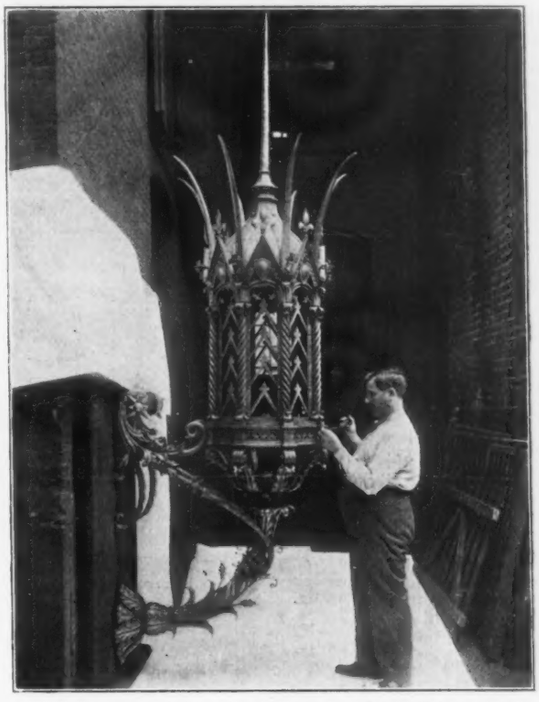


FIG. 6—ONE OF THE FIXTURES USED AT MAIN ENTRANCE IN THE ASSEMBLY ROOM OF MANUFACTURERS

by eighteen five-lamp frosted clusters supported on ornamental bracket fixtures about 10 ft. above the floor. Leading from this corridor to the one on the second floor is an attractive marble stairway which is lighted by indirect illumination. The lamps are concealed from view in the stairway molding, so that the light from them can be thrown on the ceiling and diffused.

In the Chamber of Commerce on the second floor are 120 frosted ceiling lamps supported by short rigid pendants as shown in an accompanying illustration. In this room is a stock-quotation bulletin board which is illuminated by ten lamps equipped with angle reflectors. Each of these fixtures is supported by a conduit fitting projecting horizontally from the upper edge of the board.

Offices of executives of the insurance company have been equipped with lighting fixtures selected by their occupants. In the executive office also shown herewith are elaborately decorated chain-pendent fixtures, each supporting a shower of six lamps with opal reflectors. Table lamps are also provided in this room.

The arrangement of fixtures in the tenants' offices is the same throughout the building. Rigid pendent fixtures equipped with opal reflectors are employed. In the corridors on the tenant-office floors milk-glass globes supported by ceiling pieces are used. These are arranged in a single row along the center line of ceilings, the lamps in them being controlled from lock switches on each floor.

Exterior Lighting

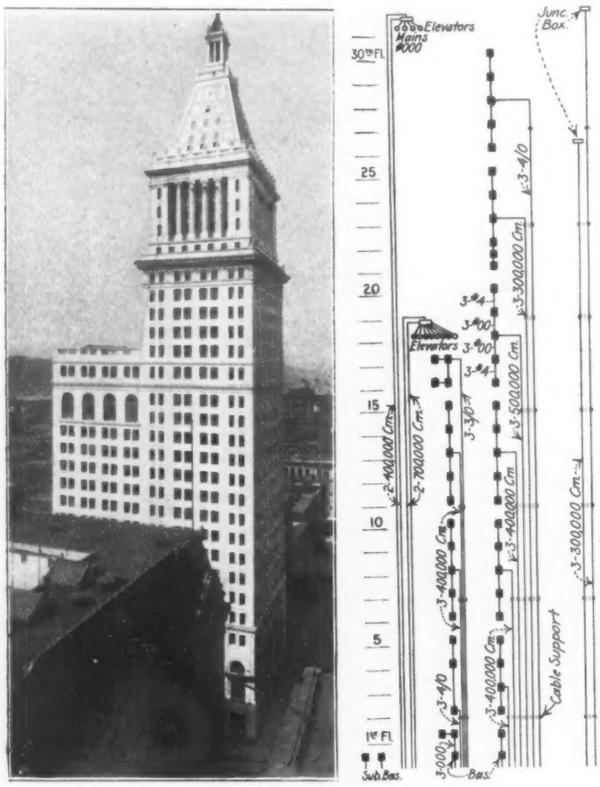
Two large hand-forged, wrought-iron lanterns, illuminating the front of the building, are mounted on each side of the main entrance. These fixtures are indeed massive, measuring about 12 ft. from the top to the base

of the support, while the lanterns themselves are about 3 ft. in diameter. They were manufactured by Mr. Samuel Yellin, Philadelphia.

Around the cornice of the building are thirty-six 150-watt lamps inclosed in 22-in. milk-glass bowls protected by wire netting. Four five-lamp pinnacle-type fixtures mark the corners of the tower. On these fixtures are supported vapor-proof globes containing 40-watt lamps. The circuits supplying the exterior lamps are incased in lead sheathing. All of the cable used in the Union Central Life Building is manufactured by the Underground Cable Company.

Telephone and Signal Systems

Telegraph cables are run up each of the riser shafts and are incased in lead sheathing which is strapped directly to the tile walls for support. The individual office circuits are concealed in sheet-metal molding.



FIGS. 7 AND 8—EXTERIOR OF CINCINNATI SKY SCRAPER, AND RISER DIAGRAM

A Gamewell fire-alarm system is installed, being supplemented also by an annunciator in the engine room in the sub-basement. Alarms can be turned in from two places on each floor. A single-stroke bell indicates the box at which a fire alarm has been turned in. Ninety-two private watchmen's clocks are installed, four being located on each floor up to the seventeenth, above which there are only two.

On one wall of the main corridor is a cordless switchboard and intercommunicating telephone system by means of which the elevator starter is able to talk with any one of the elevator operators. Motor-generator sets for operating the up-and-down elevator signals are installed on the eighteenth and thirty-first floors. After the building was completed it was found that the lamp load totaled 120 kw and the motor load 410 kw.

The Thompson-Starrett Company, of New York City, was the general contractor for the building, and the electrical work was done by the Hatfield Electric Company of Indianapolis. Messrs. Cass Gilbert, New York, and Garber & Woodward, Cincinnati, were the associated architects.

Substation Extensions in Chicago

There is much activity in the substation development of the Commonwealth Edison Company. This company now supplies practically all the energy requirements of the surface and elevated railways of Chicago. Some of the rotary converters used in the newer stations are of exceptionally large size. In December there was put into service a 4000-kw rotary in the Homer Street substation of the Chicago Railways Company. The new downtown Sherman Street substation of the Edison Company has a rating of 5500 kw. At Harding Avenue a second 4000-kw rotary for railway service will soon be in service. A duplicate of this machine and a 1000-kw motor-generator set have been put into commission recently at the Ravenswood substation. At Troy Street the fourth 1500-kva, sixty-cycle transformer has been installed.

Three new substations are under construction—Hermitage Avenue, Sedgwick Street and Sixty-second Street. They will replace the present 600-volt direct-current generating stations recently taken over from the elevated railroads and will, when completed, have ratings as follows: Hermitage Avenue, 16,000 kw for railway purposes; Sedgwick Street, 12,000 kw for railway service; Sixty-second Street, 10,000 kw for railway service and 7500 kva for Edison service.

Compact Radio Equipment of U. S. Motor Boat "Tarragon"

The United States motor boat *Tarragon*, of the Bureau of Navigation, Department of Commerce, which enforces the navigation laws, has been equipped with very compact and efficient radio apparatus. The transmitting equipment and motor-generator are mounted as a single unit on a panelboard 32 in. wide by 30 in. high. A storage battery of twenty cells operates the motor-generator and on one charge will energize the apparatus continuously at full load for about eight hours. The battery is charged by a small auxiliary gas engine directly connected to a 35-volt, 35-amp generator. The transmitter is of the quenched-gap type. A break system relay is provided, which enables the operator to be "broken" or to overhear any interference.

At present the normal wave-length of the *Tarragon* outfit is 300 m (985 ft.). In addition to this, transmitting wave-lengths of 200 m (657 ft.) and 450 m (1475 ft.) are also provided for. The change from one wave-length to another is accomplished by throwing over a six-point switch mounted on the panelboard. This single operation tunes both the oscillating and open circuits to resonance, and with a slight variation of coupling maximum radiation is obtained. The wave-length change device and the method of varying the coupling are very ingenious and were devised by Mr. F. A. Kolster, of the United States Bureau of Standards, who designed the equipment. The entire installation is rated at 0.25 kw and at the 300-m adjustment delivers a little over 3 amp in the antenna, which is of the inverted-V type, having a maximum height above the water-line of 27 ft. and a natural period of 60 m (197 ft.). Communication has already been established over a thickly wooded country to a distance of about 35 miles, indicating that at sea by night the equipment will have a transmitting range of about 150 miles.

Resonance in Radiotelegraphy—I

Modified electrical theory of resonance phenomena in high-frequency circuits, with special reference to wireless telegraphy. By J. Hettinger

IN what follows an attempt is made to give a modified electrical theory of the resonance phenomena in high-frequency circuits. The theory now more or less generally adopted has been fully developed in Zenneck's standard book on electromagnetic waves and wireless telegraphy.[1] The difference between this theory and that now put forward does not lie so much in the respective conclusions arrived at, since qualitatively they are in many respects similar, as in the premises on which they are based. In view of this statement it would appear that the proposal of a new theory, when the adopted one accounts sufficiently well for the results experimentally obtained, is superfluous. This, however, is a truism which, as the history of sciences has shown, does not always hold good.

The Present-Day Theory

It seems desirable first to give a brief outline of the essential part of the theory now adopted. For the sake of convenience reference is made more particularly to the case of two inductively coupled oscillatory circuits.

When a high-frequency current flows through a primary circuit inductively coupled with a secondary circuit it produces in the latter an oscillatory current which is to a great extent dependent upon the relation between the frequency of the current in the primary circuit and the natural frequency of the secondary circuit. The current in the secondary circuit attains its maximum amplitude when the two frequencies are equal, or, strictly speaking, nearly equal, to one another. The secondary circuit is then stated to be in resonance with the primary circuit. The oscillation induced in the secondary circuit is supposed to be the resultant of a "forced oscillation," the frequency of which is equal to that of the oscillation in the primary circuit, and of a "free oscillation," the frequency of which is equal to the natural frequency of the secondary circuit, the frequency of the forced oscillation and that of the free oscillation being thus, according to the above definition, substantially equal to one another in the case of resonance.

A graphical illustration of the theory is given in Fig. 1, wherein *a* represents the forced oscillation, which in this case is assumed to be undamped; *b* the free oscillation, which is damped, and *c* the resultant oscillation, which is obtained by reasoning as follows:

At the moment the oscillations are started, the inducing emf is either nil or at its positive or negative maximum. In the first case the current of the forced oscillation *a* is nil at this moment and the potential thereof is at its positive maximum, the potential of the free oscillation *b* then becoming equal to that of the forced oscillation but of opposite sign; that is to say, the free oscillation can only have the position shown by the dotted lines and the forced oscillation only the position shown in full lines. In the second case, namely, when the inducing emf is at its positive or negative maximum at the moment the oscillations are started, *a* and *b* represent "current" instead of "potential" curves, and so does also the resultant curve *c*, the amplitudes of which in either case are at every moment equal to the difference between the amplitude of the forced oscillation and that of the free oscillation and gradually increase until they attain, in the case illustrated, the amplitude of the forced oscillation.

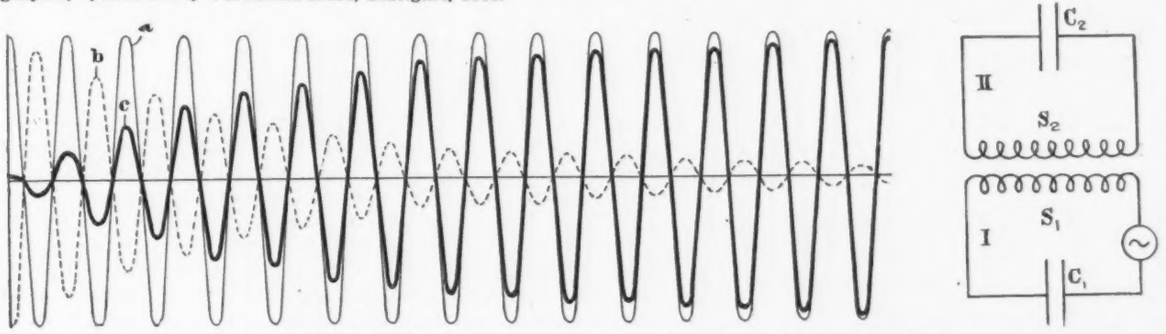
This constitutes the essence of the present-day electrical theory, a criticism of which would be outside the scope of the present article.

The Writer's Theory

The theory which the writer ventures to propose may best be explained with reference to the case in which two oscillatory circuits are inductively coupled together, such as is illustrated in Fig. 2, wherein I is the primary circuit and II the secondary circuit, and wherein the natural frequency of the secondary circuit is assumed to be equal to the frequency of the current in the primary circuit.

(a) First of all, it is but natural to admit that the oscillatory change of the magnetic lines due to the oscillatory current in coil S_1 of the primary circuit I necessarily induces a corresponding oscillation in coil S_2 of the secondary circuit II. Such induced oscillation is generally termed a "forced oscillation," and its frequency is obviously equal to that of the inducing oscillation. Fig. 3 is a diagram of a forced oscillation, in which *A*, *B*, *C* . . . . *N* represent half oscillations due to corresponding half oscillations of the inducing current.

[1] J. Zenneck, "Elektromagnetische Schwngungen und drahtlose Telegraphie," published by Ferdinand Enke, Stuttgart, 1905.



FIGS. 1 AND 2—GRAPHICAL ILLUSTRATION OF PRESENT-DAY THEORY, AND TWO OSCILLATORY CIRCUITS CONNECTED INDUCTIVELY

(b) The next natural assumption is that whatever the actual phenomena which determine the forced oscillation may be, these phenomena are repeated after each period T, and thus cause the oscillations AB, CD, EF, etc., to follow one another with the greatest regularity of time.

In other words, the electrical conditions at the moments a_1, b_1, c_1 and d_1 which determine the two half oscillations A and B are (qualitatively, and in the case of an undamped forced oscillation also quantitatively) exactly the same as the conditions at the moments a_2, b_2, c_2 and d_2 which determine the two half oscillations C and D, exactly the same as the conditions at the moments a_3, b_3, c_3 and d_3 which determine the two half oscillations E and F, and so on, whence the regularity in the repetition of the oscillations.

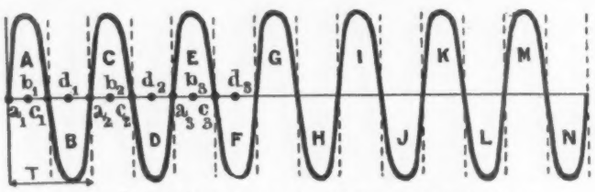
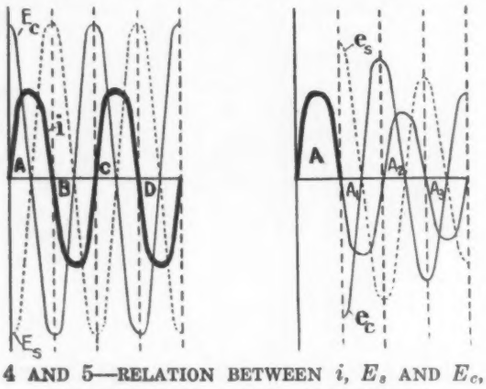


FIG. 3—DIAGRAM OF A FORCED OSCILLATION

(c) It is well known that in an alternating-current circuit containing a capacity and a self-induction the phase relation between the current (i), the emf (E_s) of the self-induction and the condenser potential (E_c), is as illustrated in Fig. 4, E_s being equal to E_c in the case of resonance. If i represents the forced oscillation induced in the circuit II by the oscillatory current in the circuit I (Fig. 2), E_s must necessarily represent the emf curve of the self-induction of the circuit II, and E_c the potential curve of the condenser C_2.

(d) Consider now the half oscillation A independently of the subsequent half oscillations B, C, etc., of the forced oscillation i, all of which are in any case independent of one another, each of them being due solely to certain phenomena forming part of a series of consecutive and identical phenomena initiated by the oscillatory current in the circuit I. This half oscillation A of the forced oscillatory current is accompanied (1) by a loss of energy due to the resistance of the circuit and (2) by a transformation of electric energy into magnetic energy and of magnetic energy into electric energy, which, theoretically, is not accompanied by any loss. This transformation of energy is determined by the oscillations represented by the curves E_s and E_c in Fig. 4 and is a phenomenon well known in alternating-current circuits.



FIGS. 4 AND 5—RELATION BETWEEN i, E_s AND E_c, AND FORMATION OF A FREE OSCILLATION

The question which next arises is as to what would happen at the end of the half oscillation A, namely, at the moment c_1 when the current is nil (Fig. 3), if no subsequent half oscillations B, C, etc., of the forced oscillation were produced. Would the oscillation be continued or would it end there? As a forced oscillation it would naturally be at an end, but in spite of this it would continue in the form of an oscillation, which in the case of resonance would be of the same frequency as the forced oscillation A. This continuation of the half oscillation A is attributable solely to the transformation of energy above referred to, which energy at the end of the half oscillation A is stored in the condenser C_2 in the form of electric energy and from this moment onward continues its transformation into magnetic energy and vice versa until the energy initially stored in the condenser is entirely exhausted, because of the loss due to the resistance of the circuit. An oscillation of this nature is generally termed a "free oscillation." Fig. 5 illustrates the formation of such an oscillation, A being the half oscillation "forced" in the secondary circuit II by the current in the primary circuit I, and A_1, A_2, A_3, the first three half oscillations which are initiated entirely by the electrical conditions prevalent in the secondary circuit at the end of A, and are completely "free" from the influence of the primary circuit. In order to indicate that the forced oscillation A is accompanied by the transformation of energy referred to but is not produced thereby, and that the free oscillation A_1, A_2, etc., is actually due to such transformation, the potential curves determining the transformation from electric into magnetic energy and vice versa in the first case have been marked E_s, E_c (Fig. 4), and in the second case e_s, e_c (Fig. 5).

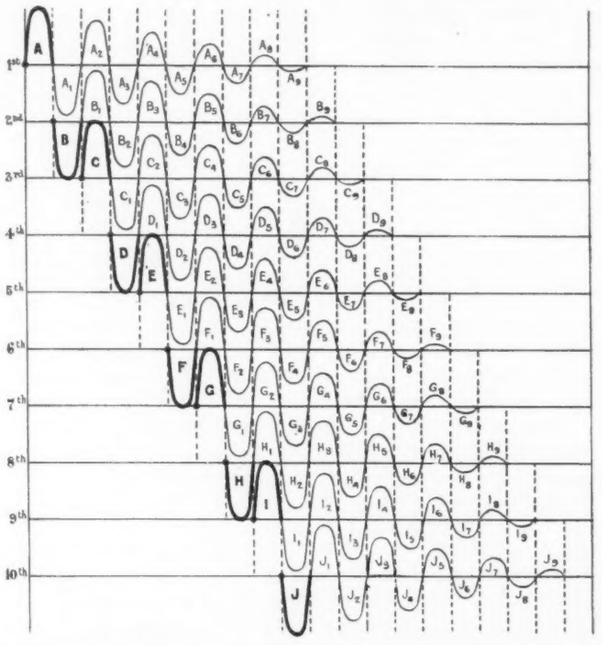


FIG. 6—FORMATION OF THE SERIES OF FREE OSCILLATIONS

(e) If each one of the half oscillations B, C, D, etc., of the forced oscillation induced in the secondary circuit and diagrammatically illustrated in Fig. 3 is considered independently of the other half oscillations, in the same manner as the half oscillation A, one necessarily comes to the conclusion that each one of them is the beginning of a free oscillation of the same frequency as that of the free oscillation which was initiated by the first half oscillation A, and which may be termed the "first free oscillation." (Fig. 6.) In view of the fact that hitherto it has always been assumed that the forced oscillation is accompanied by one free oscillation only, the above conclusion may appear

somewhat surprising and peculiar; however, it is quite natural and correct. Indeed, suppose that no first half oscillation *A* were produced—"forced" in the secondary circuit—that at the end of half a period a "forced" half oscillation *B* were started which ended after another half period, and that the same were not followed by any other "forced" oscillation. It is only natural to

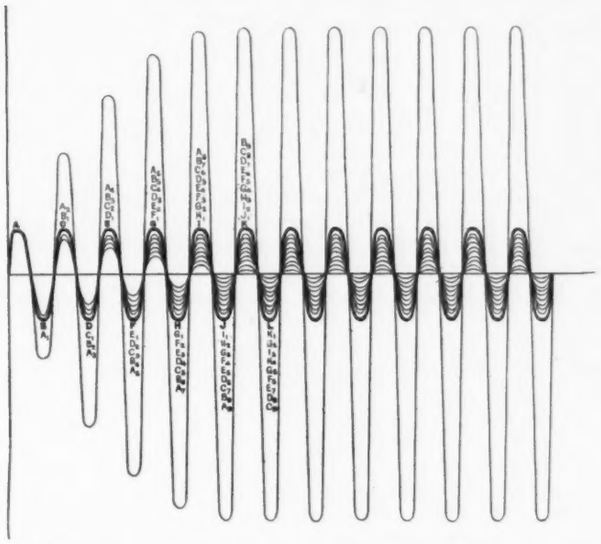


FIG. 7—SUPERPOSITION OF THE FORCED OSCILLATION AND SERIES OF FREE OSCILLATIONS

admit that such forced half oscillation must be accompanied while it is taking place by a transformation of energy similar to that above described with reference to Fig. 4, and be followed by an oscillation due entirely to the electric energy stored in the condenser C_2 at the end of the half period and to the transformation of the same into magnetic energy and vice versa, as described with reference to Fig. 5. This free oscillation initiated by the second forced half oscillation may be termed the "second free oscillation." In the same way there is obtained a "third free oscillation" initiated by the third forced half oscillation *C*, a "fourth free oscillation" initiated by the fourth forced half oscillation *D*, and so on. This series of "free oscillations" is diagrammatically illustrated in Fig. 6, which shows ten "free oscillations" initiated by the first ten half oscillations of a "forced oscillation," each free oscillation starting and ending half a period later than the preceding free oscillation, and all of them having obviously the same frequency and the same damping coefficient, because of the fact that they are all determined by the electrical constants of one and the same circuit, namely, the secondary circuit II.

Consider now the forced oscillation shown in Fig. 3, not merely in regard to its separate half oscillations but also with regard to the whole series of such half oscillations, which constitute a continuous oscillation. It appears again natural and correct to admit that the whole forced oscillation is accompanied by a series of free oscillations which are superposed to one another in the order indicated in Fig. 6. The actual superposition is shown in Fig. 7, in which is indicated also the resultant oscillation obtained by the superposition of the series of oscillations.

A comparison of the diagram illustrated in Fig. 1 with those illustrated in Figs. 6 and 7 clearly shows the difference between the present-day theory and the one just explained. While hitherto the resultant oscillation in a resonance circuit was attributed to the superposition of one free oscillation on a forced oscillation, according to the above interpretation it is attributable to the superposition of a great number of free oscillations, the first half oscillation of each of which is constituted by one of the half oscillations of the forced oscillation, or, considered from another point of view, the resultant oscillation is due to the superposition of a great number of free oscillations on a forced oscillation, each one of the free oscillations being a continuation of one of the half oscillations of the forced oscillation.

Although the theory developed under this heading of the article was originally conceived with the idea of explaining the resonance phenomenon in high-frequency circuits, the writer came finally to the conclusion, the reason for which can easily be appreciated from the above, that it is applicable to alternating-current circuits in general, whether such circuits are of low or high frequency, and whether they fulfil the condition of resonance or not. It is not the intention, however, to extend the present article beyond the scope set out in the title.

In a later issue of the *Electrical World* there will be published a further development of the foregoing theory, giving the general consequences of the resonance phenomenon and an outline of the part that high-frequency currents play in wireless-telegraphy circuits.

Electric-Lighted Advertising on Delivery Automobiles

The Boston (Mass.) coffee house of the J. M. McCracken Company recently equipped the sides of a light gasoline delivery car with reflectors and 6-volt, 2-cp lamps operated from a three-cell storage battery carried on a shelf within the vehicle body. The reflectors were designed by Mr. C. W. Merrill, and, as shown in the accompanying photograph, are placed along the edge of the roof at the top of the side panel. Each measures 3 ft. 6 in. long and 3 in. in diameter. In each reflector are mounted three lamps spaced 17 in. apart and carried on plug sockets 1.5 in. above the bottom of the reflector, which gives ample protection against the weather and good light distribution. The tail-lamp and an inside lamp, both of 2-cp rating, are supplied from the battery, which has a capacity of 80 amp-hr. and is mounted on a tray with locking bars

ELECTRICALLY ILLUMINATED ADVERTISING ON DELIVERY AUTOMOBILE

running vertically past the cell exteriors to prevent vibration and possible overturning. The interiors of the reflectors are nickel-plated and each cost about $20. The outlay for operating the lamps is less than 50 cents per week, and the advertising effect produced, even with the small sizes of lamps employed, has attracted much attention throughout the company's territory.

Building a Load-Factor on an Electric System

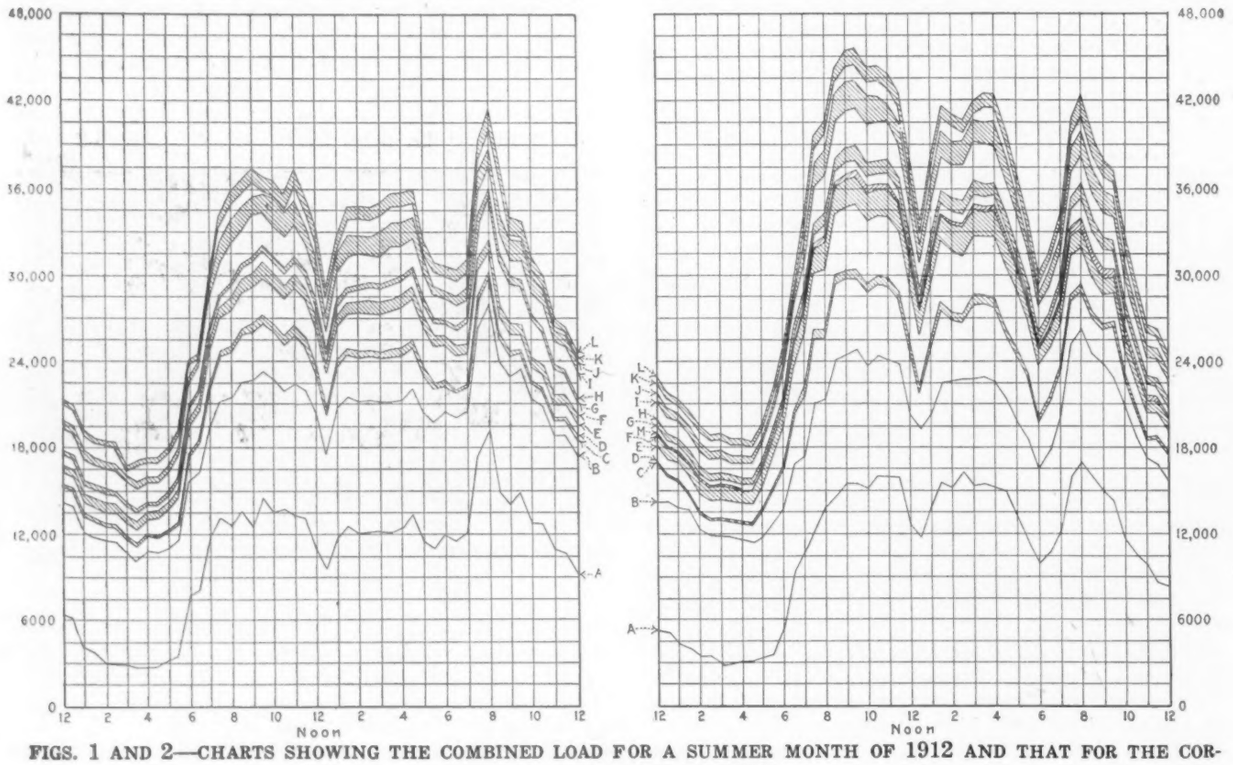
Methods of increasing the business of a central-station company and providing diversified service through extensive and intensive development. By S. M. Kennedy

IT is an easy matter to explain the difference between load building and load-factor building, but not always easy to tell how to obtain a better load-factor when building up the business of a central station. In most communities evening peak load will come without much effort, but not so with the day load and the early morning load. In order to build up a really good load-factor there must be a great diversity in the classes of service supplied, and for an electric company to reach a load-factor of 60 per cent or better apparently there must be a diversity in the communities supplied with service, in order to obtain the necessary diversity of load.

The load-factor of the Southern California Edison Company is frequently referred to as being of more than ordinary interest, and the following information and data will help to demonstrate how this company has developed an annual load-factor of 60 per cent and why a monthly load-factor around 70 per cent is not unusual.

The company referred to occupies and serves a territory which includes some thirty cities of various sizes, and in addition the intervening rural districts, which have been fairly well educated as to the advantages of electrical energy for lighting and motor uses. For operating purposes the territory has been divided into thirteen districts, each being conducted like a separate business as far as accounting is concerned, but all interconnected by transmission and private telephone lines and under the supervision of the general offices. Each of these districts has some distinctive feature peculiar to itself regarding the character of its load. Some districts embrace cities along the coast, which do a large summer business entertaining visitors from inland. Some districts are largely interested in industrial enterprises. Several districts look to agriculture and horticulture for their livelihood, and others make a study of entertaining winter tourists from the East, in addition to taking care of local needs. Just in accordance with the variance between each district's business is there a variance in the diversity of the company's load and combined load-factor. The beach towns show a high peak in the early evening during the summer months, on account of the heavy loads for decorative and amusement purposes. During the same months the inland districts have a higher peak in the daytime than at night, and in this way the system load is evened up and the percentage of load-factor pushed further up the scale. The chart herewith exhibited (Fig. 2) shows the company's combined average load for a summer month in 1913—the load of one district being superimposed upon another until the structure of the total curve is complete. An analysis of the characteristics of each district as designated by letters from "A" to "M" will help to explain the diversity of individual district curves, which make up the combined load.

District A.—This district has within its limits a city



FIGS. 1 AND 2—CHARTS SHOWING THE COMBINED LOAD FOR A SUMMER MONTH OF 1912 AND THAT FOR THE CORRESPONDING MONTH OF 1913

of more than 400,000 population, supplied with electric service by three companies. The curve shown includes some railway load, and the actual load-factor for the month referred to on the chart is 54 per cent. The consumption per capita for 1912 in District A was $9.11.

District B has a large industrial load as well as a wholesale load, energy being sold to two cities for municipal distribution. This district also has a good summer load for irrigating purposes. The consumption per capita for 1912 was $12.73. The load-factor for the month in question was 84 per cent, and in this district the load-factor never falls below 70 per cent in any month of the year.

District C shows a load that is peculiarly agricultural. The load-factor for the month shown was 46 per cent, the average daily peak being at 10 o'clock in the morning. The electric consumption per capita in 1912 was $7.66.

District D.—This is a relatively small district containing two cities of approximately 5000 each and also including a considerable orange-growing territory. The load-factor in this district is 41 per cent for the month indicated, the average peak being at 10:30 a. m. The electric consumption per capita for 1912 was $8.34.

District E, comprising three cities and having a large citrus fruit area, shows a load-factor of 52 per cent, the daily peak for the month indicated being at 9:30 a.m. In this district the 1912 electric consumption per capita was $10.96.

District F has indicated a load-factor of 41 per cent, the average peak being at 11 a. m. during the month shown. The district includes two beach cities with a rural territory having a good irrigating and some industrial load. The area covered is large, the population scattered, and the 1912 income per capita was $6.61.

District G has two beach cities and a small rural community. The load-factor for the month was 42 per cent, the average daily peak being at 8 p. m. The electric consumption per capita for 1912 was $8.07.

District H.—A district with a city of about 6000 population and a large rural territory with a good pumping load for irrigating. The curve on the chart shows a load-factor of 60 per cent, the average load at 10 a. m., 4 p. m. and 7 p. m. being about the same. The consumption per capita in 1912 was $7.01.

District I.—This district has a relatively small population, but a large motor load, the energy being used for irrigating, industrial and development purposes. The load-factor as shown is 52 per cent, the average daily peak being at 3 p. m. The annual consumption of electricity per capita was $14.21 in the year 1912.

District J.—This district includes an important beach city, with a large local business. The load-factor indicated by the curve on the chart is 46 per cent, the industrial load causing a sharp maximum peak at 10 a. m., the evening peak being broad and continued, on account of the beach amusement enterprises. Here the consumption per capita for 1912 was $8.91.

District K has an industrial and dredging load, in conjunction with the business of a harbor city. The load-factor shown equals 50 per cent, the average peak being at 10 a. m. The consumption per capita was $10.41 for 1912.

District L.—A district including a large residence city with a good suburban business and little industrial or irrigating load. The daily peak for the month indicated was at 8 p. m. and the load-factor 54 per cent. The electric consumption per capita was $7.28 during the last calendar year.

District M.—Another beach city with some rural business, similar to district G. The indicated load-factor is 45 per cent and the average daily peak at 8 p. m. The electric consumption per capita was $10.61 during 1912.

The combined load as indicated on the chart (Fig. 2) shows the company's average daily load for the month. The maximum load for the same month was 53,170 kw, the maximum peak on that day being at 9:50 a. m. On the same day the load at 4 p. m. was 49,553 kw and at 8 p. m. 49,375 kw.

Fig. 1 shows the combined average load of the company for the month of 1912 corresponding to that Fig. 2 represents in 1913. The comparison indicates the progress made in twelve months in pushing up the curve during the daylight hours. It is worthy of particular note that whereas the average daily peaks in Districts G, L and M are in the early evening, the average daily peaks in Districts C, D, E and H are during the daylight hours, so that the night peaks in some districts are counterbalanced by the day peaks in others, the result being a combined load-factor on the company's system for the month indicated of 69 per cent.

While there is a great diversity of load represented in the various districts supplied by the company, there is also a very considerable diversity of load in each district. Southern California being a comparatively new country and developing rapidly, there is a good demand for electricity for all purposes. This condition is helped along by the comparatively low rates prevailing for electric service, and the low rates are made possible by the high load-factors. The company maintains a vigilant staff of salesmen and commercial engineers. Probably 98 per cent of the houses within striking distance of the company's lines use electric lighting, and electric drive prevails for industrial plants both large and small. In addition, there are more than 100,000 electrical appliances with an average consumption of 4 amp to 5 amp each in more or less regular use among the company's customers. The relatively high load-factor obtained by this company is the result of extensive and intensive development mainly brought about through the personal efforts of its representatives in explaining and demonstrating the undeniable advantages derived from the use of electric service—to every man according to his necessity.

Night Illumination of Shop Exterior

The accompanying illustration shows the striking night illumination of the plant of the California Corrugated Culvert Company at West Berkeley, Cal. The building measures 212 ft. long, and the large sign

NIGHT ILLUMINATION OF FACTORY EXTERIOR

shown is 8 ft. high. Metal reflectors supported on conduit pipes and braced by guy wires contain 60-watt tungsten lamps, twenty-five of these units being required to illuminate the long north side of the building. On the west side, which is opposite the railway, 100-watt tungsten lamps are used, the wall being illuminated clear to the top of the gable.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Triple-Card System for Recording Travels of Meters

The Metropolitan Electric Company, Reading, Pa., employs a comprehensive system of indexing its meters so that a record is always available showing the travels of a meter from the time it is received from the manufacturer until sold to the junk dealer. Riveted to each meter case is a 0.4375-in. wide aluminum strip on which is embossed the serial number of the meter. On file in the company's offices are three sets of meter-record cards. One set contains the names of consumers using meters arranged alphabetically; another set bears their addresses listed by streets, and the third set shows the serial numbers of the meters arranged in rotation. On each of the cards are noted the meter number, dial and test constants and installation record. The latter shows the meter installations in time order, thus indicating the frequency of changes and transferences. The name cards also bear the consumer's connected load, with the type and size of the meter installed. The serial-number record card, in addition to showing the type, size and constants of the meter, indicates the names and addresses of the customers who have used the instrument.

Electricity at the New York Household Show

Among the interesting features of the New York Edison Company's exhibit at the third annual Woman's Industrial Show and Housewives' League Exhibition, held recently at the Grand Central Palace, New York,

MODEL ELECTRIC DINING ROOM AND KITCHEN

was an electric doughnut cooking pan. The central-station exhibit also included the model kitchen and dining room situated in the Edison company's booth on the main floor and illustrated herewith. The kitchen was fitted up with an ice-box kitchen cabinet, an electrically heated boiler, several standard electric irons, a washing machine, towel driers and an electric range. The dining room was furnished with such electrical apparatus as chafing dishes, percolators, toasters and a vacuum cleaner.

Doubling Electric Appliance Sales at St. Louis

After checking up the volume of appliance sales for the year 1913, the Union Electric Light & Power Company, St. Louis, Mo., announces that a 97 per cent net increase has been made in this department of the company's business over the showing for the previous twelve months. The year 1914 has been started with vigorous and aggressive campaigns which it is hoped will make this year even more productive of sales than its predecessor.

Effect of Rate Changes at Springfield, Ill.

Evidence of the fact that the general public is quick to take advantage of any opportunity to reduce electric-light bills is to be found in conditions brought about by the establishment of rates at Springfield, Ill., based on connected load and energy consumption. Carbon lamps are renewed free of charge, but since the change in rates customers are seeking a means by which their connected load may be reduced and the carbon lamp is losing its former place of preference. Mr. C. L. Owen, new-business manager for the company, says that the new rate schedule has brought tungsten lamps into use where otherwise it would have been a task to place them.

New Business Requires Double Plant Rating

As a result of the growth enjoyed during the last year by the Texas Public Service Company at Bay City, Tex., the company's present plant equipment is to be practically doubled in rating, 250 hp in boiler capacity being added with an additional 150 kw in generator rating.

Among the items of motor load that have been taken on since Oct. 1, 1912, when the present management assumed charge, are the following:

	Hp
Cotton gin	150.0
Water-works pumping	20.0
Steam laundry	10.0
Planing mill	15.0
Woodyard	7.5
Blacksmith shop	5.0
Two ice-cream factories	7.0
Garage	3.0
Printing office	2.5
Three coffee mills in stores	1.5
Total	221.5

During the same period the number of lighting customers was increased from 305 to 440, a net gain of 135, or 44 per cent. The monthly income from street lighting has been increased from $78 to $103, and a "white way," adding $55 to the company's gross income, has also been installed. Mr. W. C. Duncan is manager.

Sawing Ice by Electricity at Worcester, Mass.

A marked advance over the customary methods of harvesting ice is illustrated in the accompanying photographs, which were taken recently at the Coes Pond headquarters of the Walker Ice Company, of Worcester, Mass. In cutting ice prior to its haulage into the storehouse the usual plan is to form the blocks on the surface of the pond and to push them to the ice-house runway along a channel which is sometimes of such extreme length that the blocks freeze together before reaching the hoisting chain. The cutting is extremely tedious and the labor cost correspondingly high. At the Coes Pond establishment central-station energy supplied by the Worcester Electric Light Company has been utilized, and the sawing of the standard cakes is all accomplished by a motor-driven plant situated within a few rods of the ice-house. By this means the services of twenty two-horse teams and forty men are eliminated.

The plant consists of two sets of 36-in. Disston saws with slightly offset teeth, installed in an artificial channel about 20 ft. wide, each set of saws being belt-driven by a 35-hp, 220-volt, three-phase General Electric induction motor rented from the central station. Tests will shortly be undertaken to determine whether a smaller size of motor can handle the work satisfactorily. The ice is floated in 12-ft. by 18-ft. cakes to the head of the artificial channel, where the channelmen push it under the first row of saws, which cut seven parallel blocks 28 in. wide. These segments, still in reasonably close contact, are then turned around in the channel and are pushed through the second set of saws, which cut the cake into nine 20-in. blocks.

Time Required for Cutting

The entire operation, resulting in the cutting of each cake into sixty-three blocks, consumes barely half a minute, after which the blocks are separated by long-handled ice tools and are rapidly poled to the chain and harvested into the house at the rate of about 120 blocks per minute, a day's run aggregating about 5000 tons. The present hoisting chain is steam-driven, but next year a motor-driven chain is to be used. The services of several men will also be eliminated by the installation of an accelerating toothed cylinder in the channel outside the ice house, the cylinder to be driven by a 7.5-hp motor. A 35-hp motor-driven, 10-in. by 12-in.

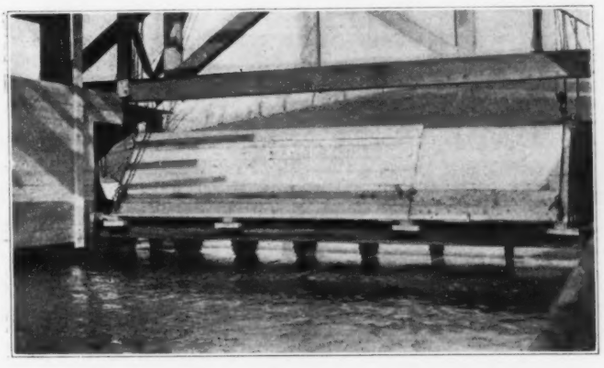


FIG. 1—ARRANGEMENT OF MOTOR-DRIVEN ICE SAW

pump is also to be placed in service to facilitate the removal of chips cut off the ice blocks as they pass into the house, all blocks being automatically chipped to a standard size of 12 in. by 20 in. by 28 in. and weighing about 212 lb. each.

The saws are driven at a speed of 400 r.p.m. on a shaft equipped with a pulley 2 ft. in diameter and connected with an 8-in. pulley by a 9-in. belt. From the latter pulley a 3-in. shaft is connected directly to the motor through a coupling, the motor speed being 1200 r.p.m. As shown, the motors are equipped with starting compensators and are started directly from the line side of the fuses, the latter being in circuit only when full speed has been attained. By means of tackle the

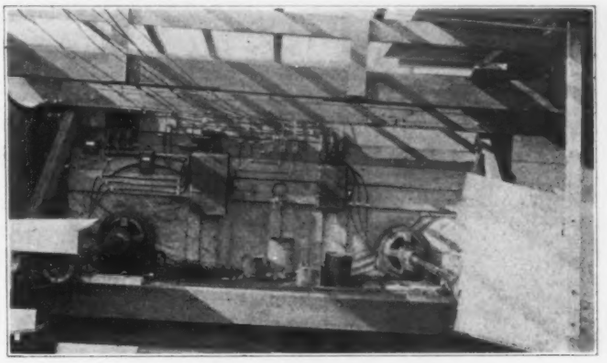


FIG. 2—MOTOR DRIVE FOR ICE SAWS

saws can be raised and lowered to meet varying thicknesses of ice and the entire outfit can readily be dismantled and assembled for service in other localities.

Power Requirements

Tests made at Coes Pond show that the power required to operate the saws in the water alone is about double that necessary in the middle of the cakes. To drive six saws which cut the ice the first time in the water the power input is 29.8 kw. While cutting the input of energy begins to drop, falling to about 15 kw in the center of the cake and increasing again to 28 kw as the ice leaves the saws. This is probably due to the heavy drag of water carried around with the saws. By this method the ice is cut into exact rectangular blocks and can easily be cleaned and harvested. The power requirements of the six-gang and eight-gang saws are practically the same. Since the plant was started it has been found advisable to insert extra bearings between the motor and the saw shaft to reduce vibration.

The Worcester installation has attracted widespread attention in the New England ice industry and will doubtless be the forerunner of others of its kind.

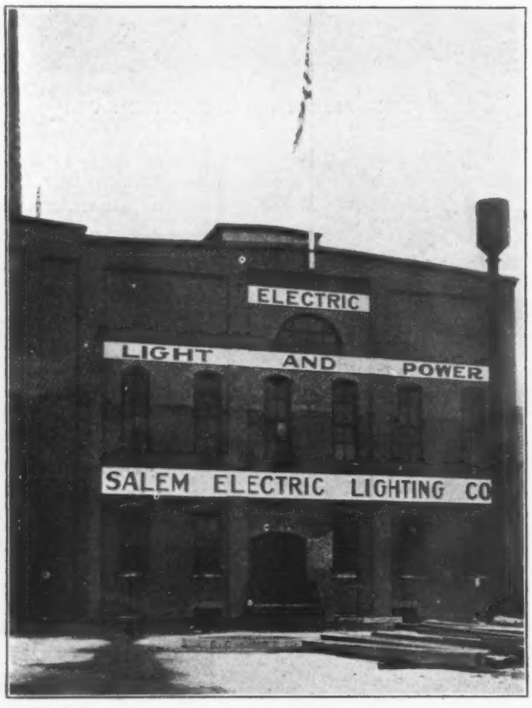
Electric-Appliance Playlet in Salesmanship Course

A feature of the salesmanship course of the Boston (Mass.) Young Men's Christian Union being given during the winter months at the headquarters of the organization was a recent electrical-appliance sales evening, which was held under the auspices of the Boston Edison Company. On this occasion the association's stage was completely equipped as an electrical appliance store, in charge of Mr. W. G. Stetson, superintendent of the appliance department of the Boston company. An informal playlet was given, in which Mr. Louis D. Gibbs, superintendent of advertising of the company, assumed the part of a "prospect" about to provide his residence "with lots of light," and the hit of the evening was a witty and impromptu dialogue between the two "stars," resulting in the purchase of an electric range, vacuum cleaner and several other appliances on an instalment basis. Washing machines, electric-heating devices and special lighting equipment were shown in full operation, and two woman demonstrators from the company's staff assisted in "convincing" the "pros-

pect" as to the cleanliness, simplicity and economy of electric service. The questions asked were specially adapted to bring out the ease with which the layman's household, from mistress to maid, could avail itself of electric cooking, lighting, heating and motor equipment, and at the close of the short act the two principals gave the audience talks upon salesmanship and advertising. Technical terms were tabooed, and the large audience, which included a number of the company's employees, maintained an appreciative interest from start to finish.

Utilizing the Blank Plant Walls

The accompanying photograph, taken at the generating plant of the Salem (Mass.) Electric Lighting Company, suggests a simple and inexpensive method of utilizing the station exterior for publicity purposes. The plant is situated near the center of the business



SIGN OF ELECTRIC LIGHTING COMPANY, SALEM, MASS.

district, and by the easy expedient of painting the company's name and service on the wall of the turbine room the attention of the passer-by is invariably attracted when he comes within range of the structure.

"Elyria, the 100 Per Cent City"

Elyria, Ohio, has adopted as its motto the slogan "Elyria, the 100 per cent city," and the local central-station company, which is owned and operated by H. L. Doherty & Company, New York, under the name "R. E. Burger, agent," will present the city with a large electric sign bearing the above legend. The company also offers to maintain the sign without charge. A location for the display, visible from passing railroad trains, is to be decided on shortly by a committee of the local Chamber of Commerce, and various sign builders will then be asked to submit designs. The slogan adopted was one of 700 suggestions received during a campaign recently conducted by a local newspaper. To the man who proposed the winning motto a prize of $25 was awarded for his idea.

Central-Station Methods at East Liverpool, Ohio

The East Liverpool (Ohio) Traction & Light Company, operating interconnected generating stations at East Liverpool and Steubenville, has undergone a substantial growth within the last three years as the accompanying load diagrams of the station outputs show. Load curves of the Steubenville plant for the three years 1911, 1912 and 1913 remained practically unchanged, as this plant was carrying its maximum rating at all times. In the case of the East Liverpool station (Fig. 2) it will be seen that the 1912 kilowatt-hour output was far ahead of that registered during 1911, while the business for 1913 bade fair to be about double that of 1911.

Plant Additions and Improvements

One 4000-kw turbo-generator unit has been added to the equipment of the East Liverpool station. After cleaning and overhauling the plant boilers it was found that enough steam could be generated with the present installation to carry the load of the additional unit. After cleaning the boiler tubes, lime in quantities was put directly into the renovated units so that a slight scale would be formed on the tubes, protecting them from the acid in the river water. Steel mills and other industrial plants dumping waste material into the streams above are said to be responsible for the acid character of the river at East Liverpool.

With the boiler tubes put into good shape the coal consumption for the plants was reduced during the past year by approximately 1 lb. per kilowatt-hour generated. Now that a new spray system for handling the cooling water has been installed even better results are expected along this line. Further savings have also been effected by the use of a home-made oil filter, a home-made water filter and a siphonic condenser intake.

Commercial Methods

As the result of aggressive and continuous sales effort 315 motor-service customers are now connected to the circuits of the company. In securing this business the solicitors tried to meet each prospective motor user on a common basis by first familiarizing themselves with the customer's business and then trying to talk from his viewpoint. With gas selling at 12 cents per 1000 cu. ft. for power purposes the task has not been easy. Rates paid by these customers are perhaps as low proportionately as any in the country, the average price per kilowatt-hour for all motor service ranging between 1.5 cents and 2 cents.

The total population of the district served by the company is about 100,000, and in this territory several small towns have been furnished with electric service.

One point which has come to notice in campaigning these villages is worthy of attention. It has been found much easier to induce the merchants in these towns to light store windows if the street lighting of the town is not taken up until the majority of the window-lighting business has been secured. With well-lighted streets in the village the average merchant wants to rely upon the general illumination to light his store window. Towns in which the reverse policy was tried are still without adequate lighting in most display windows.

Co-operation with a company manufacturing flat-rate controllers has also been instrumental in securing a good percentage of the small customers in the territory. Prior to Jan. 1, 1912, 700 "Excess" indicators were in service on the lines of the company. Since that time 755 indicators have been installed in the communities, being distributed among the residential and commercial customers as shown in the accompanying table. A commercial customer is designated as one whose business is kept open after 8 p. m. For the indicator service com-

mercial customers pay 1.5 cents net per watt of maximum demand while the charge for residential patrons is 1 cent net.

Use for Discarded Arc Lamps

Casting about for a possible use for the bases and globes of a large number of arc lamps which were being discarded, the idea of tearing out the regulating

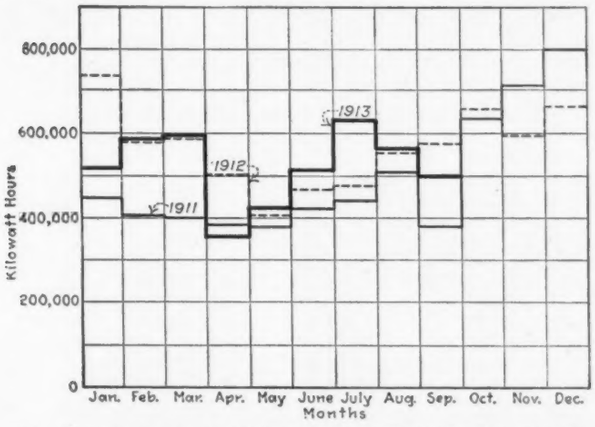


FIG. 1—OUTPUT BY MONTHS OF STEUBENVILLE POWER HOUSE

mechanism and installing 100-watt tungsten lamps was hit upon. Enlisting the services of a local manufacturing company, a telescoping arrangement was made and fitted to the sheet-metal bases of the lamps. An incandescent lamp socket was fixed to this device so that when the lamp was placed in the socket an adjustment of the telescoping tubes centered the bulb in the globe of the former arc lamp.

These units are installed for street lighting and for illuminating fronts of stores and theaters. The electric-service company owns and maintains the lamps, making a monthly flat-rate charge of $1.50 per 100-watt lamp for the lighting.

All of these "tungsten arc" lamps, as they are called,

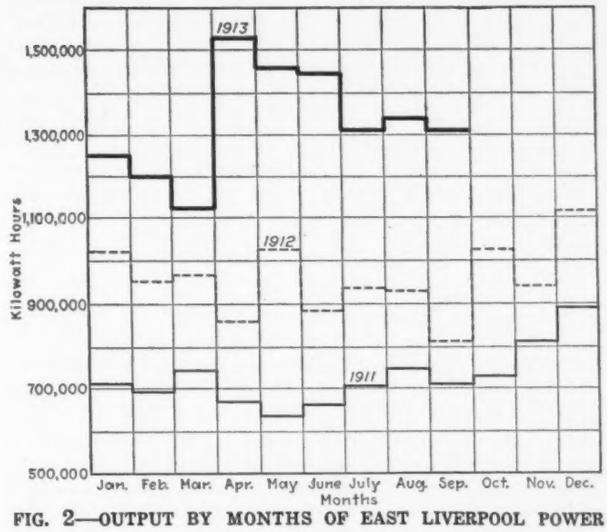


FIG. 2—OUTPUT BY MONTHS OF EAST LIVERPOOL POWER HOUSE

are connected on a special circuit arranged for the electric-sign and display lighting. With an average of four and one-half hours' operation, these lamps net the company about 7 cents per kw-hr. for energy consumed.

In most instances it has been found good practice to connect all window and display lighting on the special sign circuit. Since this feeder is controlled from the power house or the substations in the respective districts the hours during which it is operated are definitely known. As a result energy for sign lighting is sold at prices ranging from 5 cents to 6 cents per kw-hr., even though it has to be carried through the lighting peak. At the outset of the first electric-sign campaigns conducted by the company inexpensive signs were made and sold to the company's patrons at cost.

STATISTICS OF EQUIPMENT INSTALLED ON SYSTEM

District	EXCESS INDICATORS		Electric Signs	Tungsten "Arc" Fixtures
	Residential	Commercial		
Steubenville	196	4	63	91
East Liverpool	259	18	64	172
Beaver County properties	228	50	33	107
Installed before Jan. 1,1912	700	....	....	....
Total	1383	72	160	370

Two Years' Work in a Minnesota Town of 1500

As proof of the results which can be accomplished by two years' work in a small farming community without the assistance of a professional solicitor, the central-station manager in a Minnesota town of 1500 population has sent us the accompanying interesting facts relating to the inauguration and development of service by his company.

The latter secured its franchise in August, 1911, and on Dec. 2 of the same year commenced operation with one 100-hp Corliss engine, one 75-kw, 2300-volt generator and one 16-in. by 60-in. boiler.

The records of Dec. 1, 1913, two years later, showed the following figures: Total customers, 309; motor customers having 1 hp or more, 23; electric irons, 153; washing machines, 47; disk stoves and toasters, 29; water heaters, 6; fans, 28; forge blowers, 7, and motors (1-hp to 15-hp), 39. Thirteen five-lamp ornamental posts were secured for lighting the main street at the same time that forty-eight 100-watt series lamps were installed on other streets of the town, displacing gas lamps. The plant equipment now includes two boilers and an additional 200-kw generator and 250-hp Corliss engine. The company will soon add another boiler.

This street-lighting business was secured in competition with a municipal gas plant in which the citizens took quite a pride. Needless to say, none of the advertising matter used in furthering electric service mentioned gas in any way nor was a word spoken against it. In soliciting new customers, the manager invariably asked them to "try electricity" and then to use their own judgment as to which was best. In this way the friendly sympathy of the citizens was secured for the company. The municipal gas plant now has only one residence-lighting patron and no business place, and at present operates mostly for the domestic-science cooking service in the local high school. As stated before, no solicitor was employed by the electric company, but form letters, newspaper advertisements and manufacturers' advertising literature were employed liberally.

The community contains no manufacturing plants of any kind except one flour mill which has not been secured as a central-station customer. The local population consists mostly of retired farmers and the merchants doing business in town.

The manager reports that his initial selling efforts were devoted particularly to the small and poorer homes and to those retired farmers who were known to hold their money the "closest." Shortly, however, when it was seen that these people who did not use gas could and did use electricity (even guaranteeing $1 a month minimum) all the other citizens who had aspirations to be up to date fell rapidly into line. Four of the company's customers live entirely on their pensions, but say they would not be without electric light and the use of electric flatirons in summer. At the present price of the 5-amp meter such customers constitute "good business," declares the manager, if a good share of the population can be secured.

The ratio in the case of the town cited is better than one customer to every five inhabitants, which places it in the front rank with the best cities in the country.

It is of interest to note that the manager formerly served elsewhere in Minnesota on the staff of the Consumers' Power Company, and there learned modern methods of going after and getting new business. In a small town these methods can be applied even more intensively than in a larger place, he declares, for as the local executive meets and learns to know his people and their conditions, he is better able to see things from their point of view and can figure on the scale of installations which they actually need or can afford. No drop cords are used in lighting installations. For cheap construction ceiling pull-chain outfits, with shades, are provided. Twenty-four-hour service was given from the beginning, as the management figured that if this could not be afforded it had better not start at all.

Advertising to Office-Building Tenants

Tenants in office buildings often pay too much for electric lighting, or, where the service is included in the rent, more than they realize. The Commonwealth Edison Company of Chicago mentions a case in that city where the tenants in an office building pay 16 cents per kw-hr., when the maximum rate of the electric-service company is 10 cents. The company calls attention to this matter in a recent daily newspaper advertisement, reproduced herewith. The advantages of quality as well as cost of central-station service are pointed out.

How Commonwealth Edison Service Aids Office Building Tenants

Cost frequently 50% less

IN a prominent downtown office building that makes its own electricity—the tenants must pay 10c per kilowatt-hour for Edison Electric Light. This is only one instance typical of many.

Service unfailing light—reliable elevators

The recent rate reductions now make the cost of Commonwealth Edison Service 10c net per kilowatt-hour for the maximum portion; 5c net per kilowatt-hour for the secondary portion; and, 4c net per kilowatt-hour for the tertiary portion. This tertiary rate will be cut to 3c net, March 1st next.

Clean no soot and dirt from belching chimneys

How about your case, Mr. Office Renter? Has your building a private plant or Commonwealth Edison Service? Find out these facts before you renew your lease; or, before you think of renting new quarters. Commonwealth Edison Service is your safeguard.

Quiet no jarring vibration

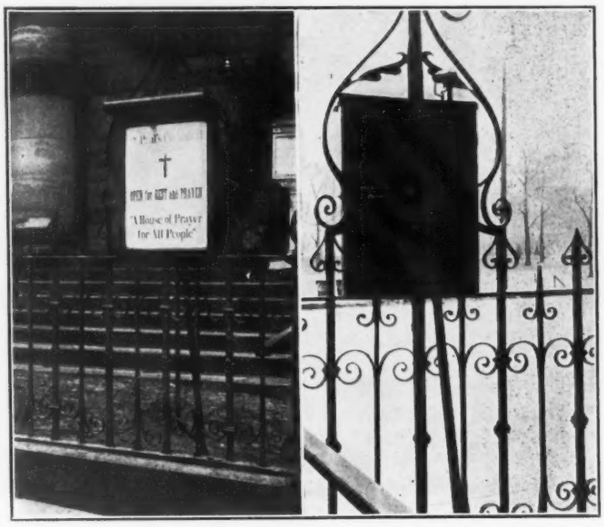
Commonwealth Edison Company
120 West Adams Street

ADVERTISEMENT CALLING ATTENTION TO EXCESSIVE COST OF ELECTRICITY

Illumination and Wiring

Illuminated Bulletin Boards

Effective use of electric illumination during the winter months is made by St. Paul's Cathedral, Boston, the diocesan church of the Episcopal communion and one of the historic edifices of New England. At the main entrance on Tremont Street two 20-in. by 26-in. bulletin boards are installed, one on either side of the central gate, and announcements of services are featured with the aid of incandescent lamps concealed in scroll-shaped reflectors at the tops of the boards. Each bulletin is equipped with two 16-cp lamps of the tubular type, the reflectors being 7 in. wide and 2.5 in. deep and cutting off all glare from the face of the bulletin. The lamps are wired through condulets to iron conduit carried down the back of the bulletin board. A key switch is installed in a small iron box at the fence rail, being covered with a leather guard as a protection against moisture. From the switch box the conduit leads into the cathedral after passing under the lawn. It is stated that the attendance at services after dusk has been much increased by the use of these illuminated bulletins with their cheerful invitation to passers-by.



FIGS. 1 AND 2—FRONT VIEW OF ILLUMINATED BULLETIN BOARD, AND REAR VIEW SHOWING SWITCH BOX

Interesting Fire-Pump Connection in Chicago

Perhaps the most interesting electrical feature of the equipment at the new assembling factory of the Ford Motor Company in Chicago is in the connection of the emergency fire pump. The service enters the building through a 3000-amp, 220-volt switch and then passes through the maximum-demand meter. Here the circuit is divided, one branch being taken to the fire pump and the other to the house-service switch. By this arrangement the house-service switch may be opened while the fire pump is being periodically tested, reducing the maximum energy demand. Since the charge is based on a demand and energy rate the monetary saving to the Ford company is considerable. It is said that this is the first fire-pump installation in Chicago where advantage has been taken of the single maximum-demand meter type of connection.

Distribution Equipment Cost on a Small System

In a recent report to the lighting committee of the town of South Hadley, Mass., by Mr. William Plattner, manager of the North Attleboro (Mass.) electric lighting department, a thorough study was made of the cost of the local distribution system. The value of the equipment in use was based upon the market price of its replacement, as of August, 1913, and transportation charges, freight and express and the labor cost of installation were included. Extracts from the various tables of unit cost submitted are given herewith, in view of their interest to the manager of the small central station.

ENGINEERING DATA FROM SOUTH HADLEY REPORT

(Estimated Cost of Replacing Various Equipment)

Number and Kind	Poles in Place		
	Cost	Length, Feet	Expected Life Years
315 first class	$1180.25	25	15
63 first class	283.50	30	15
132 second class	528.00	25	10
28 second class	126.00	30	10
94 third class	376.00	25	5
18 third class	81.50	30	5
11 fourth class	44.00	25	Need replacement
1 fourth class	4.50	30	

Painting 129 poles	$64.50
Setting 71 poles in concrete	35.50
Setting 4 poles in curb	2.00
Fourteen guys.—80 ft. No. 4 copper wire, 299 ft. No. 6 copper wire, and 444 ft. No. 6 galvanized steel wire, all in place	85.75

ELECTRIC METERS (G. E. TWO-WIRE)

No.	Size, Amp	Unit Cost	Total Cost	Transportation	Labor, Erection	Total	Total per Meter
40	5	$10.00	$400.00	$13.00	$20.00	$433.00	$10.82
267	10	11.20	2990.48	81.25	135.00	3206.73	12.00
17	15	12.80	217.60	5.00	10.00	232.60	13.65
31	25	16.00	496.00	9.50	16.00	521.50	16.80
11	50	21.40	235.40	3.67	8.00	247.07	22.36
2	100	26.70	53.40	1.00	5.00	59.40	29.70

TRANSFORMERS (G. E. AND STANLEY, VOLTAGE 1100-2200; 110-220)

No.	Size, Kw	Unit Cost	Total Cost	Freight Charges	Labor, Erection	Total	Total per Transformer
65	1	$21.80	$1417.00	$23.90	$96.00	$1536.90	$23.60
16	1.5	26.00	416.00	4.00	24.00	444.00	27.80
21	2	30.40	638.00	10.40	30.00	678.40	32.20
9	2.5	34.00	306.00	5.00	18.00	329.00	36.60
10	3	38.00	380.00	5.00	19.00	404.00	40.40
2	4	45.60	91.20	2.90	5.00	99.10	49.55
9	5	53.20	478.80	9.20	18.00	506.00	56.22
2	7.5	70.40	140.80	2.68	10.00	153.48	76.74
3	10	87.20	261.60	3.80	20.00	285.40	95.13
1	20	146.80	146.80	2.74	18.00	167.54	167.54
1	25	172.80	172.80	4.00	18.00	194.80	194.80
1	30	197.20	197.20	5.50	22.00	224.70	224.70

The transformer costs include fuses, cut-outs, hangers and oil.

TRANSFORMER HOUSE, SOUTH HADLEY

One house, matched boards, 7 ft. 3 in. by 7 ft. 3 in. by 9 ft. 9 in. high in front, 8 ft. 6 in. high in rear, tar-paper roof, paneled window, wire screen door, painted	$75.00
One G. E. regulator, type I R.S., 8.75 kva, 2300 volts, 25 amp, complete with panel and transformers	468.40
One G. E. constant-current transformer, 10 kw, 5.5 amp, form G, complete	304.50
One G. E. transformer, 1 kw, oil type, 2200 volts to 110-220 volts	16.73
One Campbell time switch, series street lighting, 2500 volts, two-pole, 25 amp, eight-day clock	25.00
Two G. E. 2300-3000-volt horn-gap lightning arresters	9.50
Inside wiring, material, labor, etc	35.50
Outside wiring, including 300 ft. service for lighting	21.75
Total	$956.38

Electric Truck with Removable Tower

The Union Electric Company, Dubuque, Ia., has in use an electric 1-ton truck which is equipped with a removable trolley-repair tower so that the vehicle may

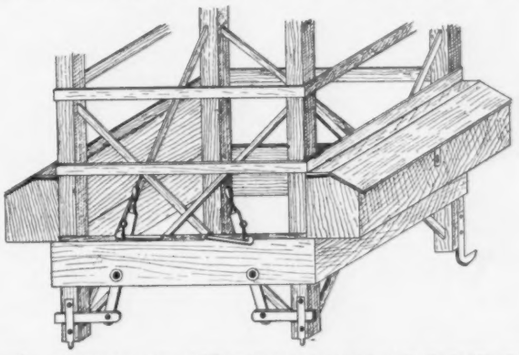


FIG. 1—METHOD OF ATTACHING TOWER OF TRUCK BODY

be employed either as a regular delivery truck or as a tower wagon. When not in use the extensible tower is hung on ropes and pulleys in one corner of the garage. To convert the truck into a trolley-repair wagon, it is backed under the suspended tower and the framework is lowered by means of the double windlass at the right. Bolts hold the tower in place on the body

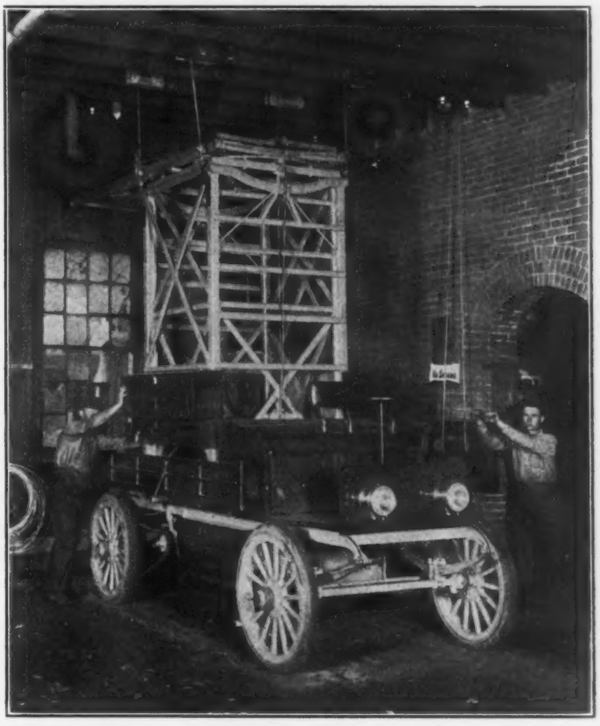


FIG. 2—TRUCK WITH REMOVABLE TROLLEY-REPAIR TOWER

of the wagon. The chassis of this General Vehicle truck, which is equipped with an Edison battery, was purchased by the Dubuque company about twelve months ago, tower and body having since been built in the company's own repair shops. Mr. H. G. Gorr, superintendent of light and power, designed the removable tower shown.

Safeguarding Wires at a Factory Substation

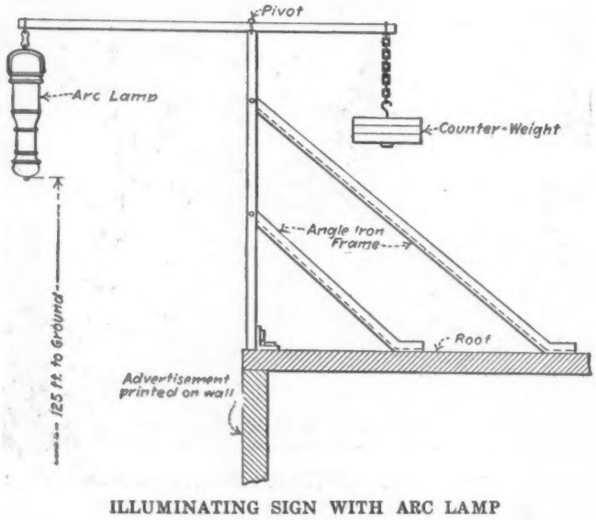
Improved standards of construction are evident in the accompanying photograph of the substation of the Coes Wrench Company, Worcester, Mass., a feature being the manner in which the incoming 1300-volt wires are

1300-VOLT ENTRY CONSTRUCTION

protected against the weather. Each line wire is dead-ended by a spool-shaped strain insulator mounted between an iron bracket and a moisture-proof box carried at the eaves. The lines are carried into the building by connections clamped to the incoming leads at an angle of about 60 deg., insulated bushings being set into the under side of the entrance box as illustrated. The box itself is provided with a slate roof, which makes it waterproof.

Arc-Lamp Sign Illumination

Although the lighting of billboards by incandescent lamps is not new, the application of arc lamps to a



ILLUMINATING SIGN WITH ARC LAMP

similar use is less common. The general scheme employed in a city of the Middle West for lighting a department-store sign by flame lamps is shown in the sketch herewith. Facing one of the main railway stations, the advertising space on which the sign is painted comes within the view of a large percentage of the population. The bright light sources suspended from the angle-iron framework on the building illuminate the wall and yet are high enough above the sign not to obstruct vision with their glare. The color contrast with other signs within the eye's range presents an added attraction.

The supporting framework is simple but substantial. For trimming, provision has been made for swinging the four arc lamps in the installation back over the roof. Counter weights at the opposite ends of the beams reduce the bending strain on the angle-iron structure.

Street Lighting in Large Cities

At a joint meeting of the New York Section of the Illuminating Engineering Society with the Municipal Art Society at New York, Feb. 11, Mr. Arthur Williams presented "Some Notes on Present-Day Street Lighting," and Mr. C. F. Lacombe, chief engineer department of water supply, gas and electricity, New York City, read a paper on "The High-Intensity Lighting of European Cities Compared with New York," which he illustrated with numerous lantern slides reproduced from pictures taken during a recent trip abroad to study lighting conditions.

Whether electrical energy for street illumination shall be purchased from a central station or generated in the city's own plant is simply an economic question, declared Mr. Williams, depending on which method costs less under local conditions. The service for New York City is obtained from the local companies, while that for Chicago is chiefly generated in municipal plants. New York's public lighting bill for 1912, the latest year for which figures are available, was itemized as follows:

Electric lighting	$2,201,000
Gas	1,038,000
Naphtha	51,000
Total	$3,290,000

This total represents an individual tax of 65 cents per year per capita, or 0.8 mill per day per person.

The accompanying table, also presented by Mr. Williams, compares the number of arc lamps and population in representative American cities:

City	Population	Number Arc Lamps
Albany, N. Y.	105,000	1,000
Baltimore, Md.	500,000	2,900
Boston, Mass.	720,000	3,850
Chicago, Ill.	2,300,000	8,920
Cleveland, Ohio	560,000	4,592
Los Angeles, Cal.	325,000	7,400
New Orleans, La.	340,000	3,400
Philadelphia, Pa.	1,600,000	14,000
Pittsburgh, Pa.	500,000	4,400
New York (Manhattan and Bronx)	2,900,000	9,900

The form of "bishop's crook" lamp-post in use in New York City, said the speaker, is the result of long and careful study of a large number of designs, both American and European, final approval having been accorded the accepted design by the late Stanford White.

In his address comparing public lighting conditions in European cities with those in the United States, Mr. Lacombe emphasized the very high intensities employed abroad in thoroughfares of high traffic density, the illumination being so great that objects are seen directly by their own reflected light rather than by silhouette. In London, Paris and Berlin, for example, the principal streets show intensities as high as 7.9 ft.-candles to 2 ft.-candles at locations near the lamps, with minimums

of 0.25 ft.-candle to 0.5 ft.-candle at more remote points. Compared with these high values, similar streets and plazas in New York City, like Times Square, Fifth Avenue, etc., have maximum intensities not exceeding 1.2 ft.-candles on the street surface, while the minimums fall as low as 0.08 ft.-candle. In Fifth Avenue directly beneath the double-lamp standards intensities of 1.7 ft.-candles are found, with minimums of 0.05 ft-candles.

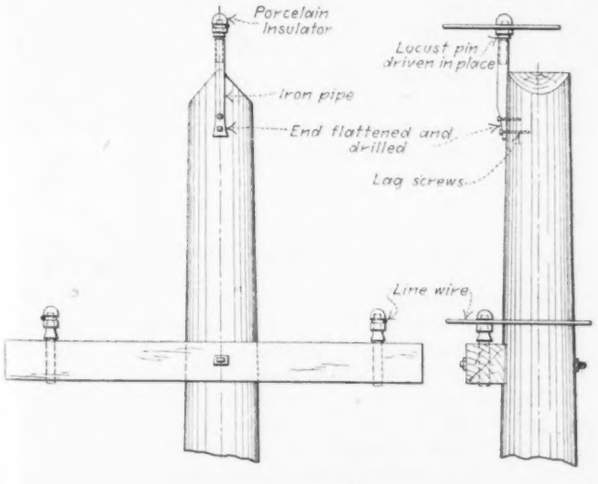
In Europe manufacturers have developed highly efficient types of flaming-arc lamps to operate several in series from multiple circuits, the control of the lamps being effected by pilot wires led from central points. Abroad all such high-candle-power units are placed from 3 ft. to 10 ft. higher than is the practice in America. At these greater elevations the lamps are removed outside the glare angle, and it is possible to employ clear-glass globes, contributing to the efficiency of the lamp units. American business thoroughfares benefit largely from the coincident store-window and sign lighting. In Europe the high-intensity lighting is usually partly diminished after the hours of heavy traffic.

Abroad, said Mr. Lacombe in closing, there is an utter lack of artistic or scientific interior lighting. In this respect, as in the use of tungsten units, he declared, American practice is far in advance of European methods.

Iron-Pipe Top Bracket on 2200-Volt Line

A few years ago certain transmission companies tried the practice of making inexpensive top brackets for three-phase lines by setting large locust pins in holes bored in the tops of the line poles. Owing to the fact that the bored holes acted as catch-basins for rain water to accumulate in, the scheme proved impracticable. A few winters, therefore, saw the elimination of most of this type of home-made bracket, with the substitution of sturdy manufactured cast-iron brackets fixed to the poles by lag screws.

The Menominee & Marinette (Wis.) Light & Traction Company in erecting a short line to serve the homes of its station operators near the hydroelectric plant at Ingalls recently hit upon a plan for combining the lasting qualities of the cast-iron bracket and the

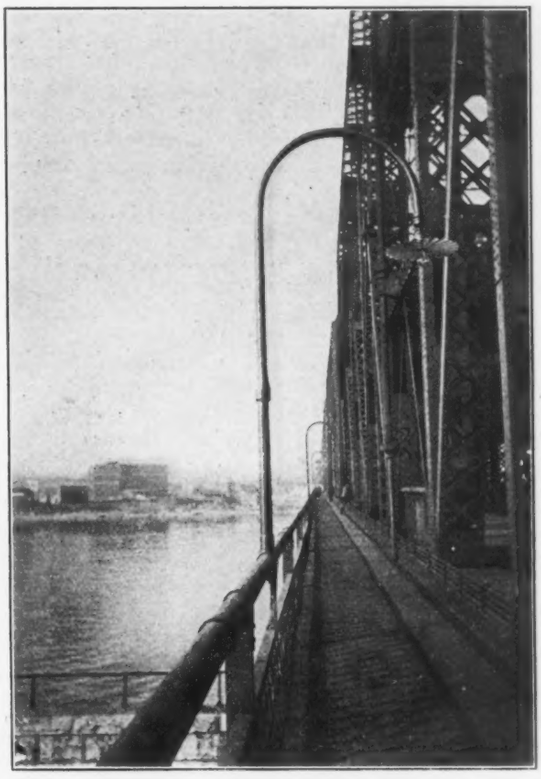


IRON-PIPE TOP BRACKET

inexpensive feature of the home-made pole-top pins. The bracket consists of a 15-in. length of iron pipe flattened at one end and drilled to receive the lag screws which fasten it to the pole. Ordinary locust pins selected to fit the pipe tightly were driven into the top of the pipe before it was put in place.

Bridge Wiring and Lighting at Davenport, Ia.

On one of the bridges which span the Mississippi connecting the cities of Davenport, Ia., and Rock Island, Ill., incandescent lighting units of the type shown in the illustration herewith have been installed. The cir-



BRIDGE LIGHTING, DAVENPORT, IA.

cuits feeding the lamps are drawn through the iron pipe which forms the hand rail, multiple taps being taken off through holes drilled in the top of this pipe and carried through the hollow standards to the lamps. Since a portion of the bridge is swung for vessels passing up and down the river, circuits have been brought in from each end and are controlled from the houses of the watchman situated at the ends of the bridge. Tungsten lamps have not yet been used for this bridge lighting as trains passing over the upper deck of the structure set up vibration which the authorities feared might shorten the life of the lamps. The units are spaced about 30 ft. apart and line the pedestrian walks.

Recent Telephone Patent

To the Gray Telephone Pay Station Company has been assigned a patent granted recently to Mr. G. A. Long, of Hartford, Conn., the design of which is similar to that of a prepayment gas or electric meter. Provision is made for the deposit in advance of any convenient coin or coins which give credit for service to be rendered later. A proper charge is deducted for each call until the amount of money prepaid has been exhausted. An indicator may be provided to show just how much unexpended money is on hand in the box. A lever is pulled after each coin is deposited which steps the control mechanism through gearing a definite distance from its stop. Each time a call is made a push-button is pressed to give the operator a signal. This operation causes the control device to move a certain distance, thus indicating how much should be deducted.

Letters to the Editors

Cost Figures from Brookings, S. D.

To the Editors of the Electrical World:

SIRS:—In your issue dated Dec. 27, 1913, you publish on page 1321 an article entitled "Cost Figures from Brookings, S. D.," by Mr. E. M. Soreng.

According to this article, the Brookings municipal plant shows a total net revenue in ten years of $50,000.

I herewith submit a statement of the operations of the plant for 1912, the amount of gross revenue, plant cost and cost of coal being those given by Mr. Soreng.

ANALYSIS OF COSTS AT BROOKINGS, S. D.

Plant cost		$41,000.00
Revenue, 1912:		
Commercial electric		$15,600.00
For street lighting, estimated		1,500.00
For heating		5,600.00
Total revenue		$22,700.00
Expense, 1912:		
(Rate of wages estimated per month.)		
One superintendent	$100.00	
Two engineers ($90 each)	180.00	
One fireman	60.00	
One lineman	80.00	
One assistant lineman	40.00	
One auditor	50.00	
Total for year		$6,120.00
Coal		9,000.00
Taxes, 2 per cent.		
Insurance, 2 per cent.		
Interest, 7 per cent.		
Depreciation, 6 per cent.		
17 per cent of $41,000		6,970.00
Employer's liability at $3.75 per $100 of payroll		229.50
Oil, waste, water, cinders		250.00
Gross expense		$22,569.50

No account is taken above of the expense of general repairs and supplies, including transformers, meters, series lamp renewals, station supplies, boiler, engine and machinery repairs.

It would seem to me that a system of accurate bookkeeping would be of assistance to some municipal plants and prevent them from misleading, not only themselves, but the public, which is not always sufficiently versed to get underneath the actual cost of producing and distributing electric energy.

Omaha, Neb. A. V. KENT.

To the Editors of the Electrical World:

SIRS:—In the lighting and heating plant referred to in my article in the *Electrical World* of Dec. 27, 1913, two parties are interested—the public, on the one hand, we will say, and the city corporation, on the other.

The people are interested in getting good service at a just and reasonable rate, and we may assume that if this condition obtains it makes no difference to them whether the service is obtained from a private plant or from a municipal plant. The city as a corporation is interested in making the plant a financial success, for obvious reasons.

In reply to Mr. Kent's comments on my figures, I will say that my article did not pretend to be a detailed statement of the expenses and earnings of the plant, but it was intended to show that the plant is a financial success. Assuming that the public has been fairly treated, we can regard the plant from the point of view of a private investment.

There are certain facts, however, which need to be cleared up.

First, Mr. Kent assumes certain values for wages which are somewhat higher than are the actual costs.

Second, the amount that has been credited to the plant for street lighting is an average for ten years and not the amount to be credited at present. As a matter of fact, the amount that has been levied during the last two years is $3,000, which amount has been agreed on for the last six years.

Third, in his analysis of costs, Mr. Kent further assumes interest at the rate of 7 per cent. This would probably be a fair rate for a private investment, but in the case of this municipal plant the money invested in the shape of bonds bears 5 per cent interest, and this represents a real advantage of the municipal plant over the private plant.

In the case of the above plant, when the bonds are paid off, this interest money amounts to a real earning and is available for any purpose. The item of 6 per cent for depreciation also vanishes when the bonds are paid. Both interest and depreciation are figured as a percentage on the capital investment, and when there is no capital invested they represent a real earning.

Assuming in this case that the street lighting had been paid for in cash, the plant would be in the position of having earned at least $9,000 above its cost in ten years after paying all legitimate expenses against it. The city is, then, in the position of owning a piece of property which has not cost it anything and against which no interest or depreciation can be charged.

On this basis the analysis of costs is as follows:

Plant cost	$41,000
Revenue, 1912:	
Commercial electric	$15,600
Street lighting	3,000
*Heating	6,065
Total	$24,665
Expenses for 1912:	
One superintendent	$1,200
One engineer	960
One engineer	840
One fireman	720
One lineman	720
One assistant lineman	350
Auditor (part time)	600
Coal	9,000
Oil, waste, water	300
Taxes (2 per cent)	820
Insurance (2 per cent)	820
Lamps, meters, etc.	600
Total expense	$16,930
Net earnings	7,735

*The amount of revenue from heating for 1912 was $6,065 instead of $5,600, as estimated in my article of Dec. 27.

This amount represents a real earning, and part or all of it can, if so desired, be used as a sinking fund to replace the plant when the latter is worn out, or it may be used for any other purpose agreed upon.

Milwaukee, Wis. E. M. SORENG.

Fireproof Electrical Devices

To the Editors of the Electrical World:

SIRS:—Interesting proof of the ruggedness of present electrical apparatus was given in this city recently when a tailor's shop burned. An ordinary electric iron found in the ruins of the shop had its handle burned off, the cord destroyed and the nickel finish blackened and discolored. Furthermore it was badly soaked with water. A new cord was fitted, and the current turned on. The iron heated up at once, and after a few minutes' popping, due to the water inside, there was nothing in its performance to indicate that it had ever been in any trouble. The iron was an inexpensive one, sold under the name of the "Red Shield."

A Sangamo meter in the shop was also exposed to considerable heat and smoke, and, although blackened and smelling of fire, it still showed its original accuracy.

A large General Electric tailor's goose, although not exposed to such extreme treatment as the smaller iron, was found in good shape after the fire, with the exception of a burned handle and discolorations.

Bowling Green, Mo. COLIN K. LEE.

The Low-Priced Electric Vehicle

To the Editors of the Electrical World:

SIRS:—In your issue of Jan. 17 appeared an account of the plans by which Mr. Henry Ford proposes to produce a low-priced electric vehicle, and also an editorial on the same subject.

It is perhaps only natural that a journal which is so closely identified with the central station's interests should take the view that the mission of the electric automobile is to supply revenue to the producers of electrical energy. We have heard repeatedly from members of the Electric Vehicle Association of America that the chief trouble with the electric vehicle industry is that the price of its products is too high and that before long some manufacturer will come to the front by bringing out a car at a low price and built in enormous quantities—making a fortune for himself and for the central-station man and benefiting humanity generally by filling a long-felt want.

Those manufacturers who have been in the business the longest and have heard this cry the most have perhaps had the best opportunity to consider its real value. Seven or eight years ago, when activity in electric-car building took renewed life, there was a leaning on the part of the public toward buying open machines—stanhopes, runabouts and victorias—in spite of the fact that an electric vehicle company had for years before built many closed cars. Even then, the better of these open models in finish, construction, speed and mileage constituted the paying proposition from the builders' standpoint, since they were the ones the public was buying, although the highest in price.

From this time onward the demand has been continually for larger and finer cars. Within a few years of the time above mentioned the coupé and other closed models crowded out the older types with their lighter weights and lower costs, and it is a significant fact that the manufacturer who attempted to market anything at less than $2,000 either went to the wall or had to come to a higher price.

The tendency is still in the same direction. There is no buying class that wishes a car costing $600 to $1,000. The man with this amount of money to spend wants speed and mileage. Most likely it will be his first car; he will want to get out into the country. The car you mention is figured to give 100 miles per charge, but from any figure of watt-hours per ton-mile attainable by careful design, the use of special tires and the best of mechanical and electrical work, such a car would be compelled to go excruciatingly slow to make the desired trip over average country roads; and quantity production should not make such a car go much faster.

That the cheap electric vehicle is not desired is shown by the fact that second-hand open cars can be bought for $600 and less which have more real value than a new car at the same figure. Electric cars seem to have some of the peculiarities of ladies' hats—their second-hand price is very low when real value is considered—and dealers in electric cars who have "traded-in" a quantity of the "junk" made several years ago would extend a hearty welcome to that part of the dear public willing to buy a car at an "everyman's" price.

The writer's recollection is that, according to the Edison battery people's own statement, they are about breaking even at present prices of their battery. Today the vehicle manufacturer would pay about $360 for the 405 lb. of Edison battery. If the dealer is to obtain his twenty per cent, the vehicle manufacturer would still have $120 to cover material, labor, burden, and possibly profit, and anyone who has had any experience with the manufacture of these machines and who knows anything about the cost of tires, motors, anti-friction bearings and the hundred and one other items will find this close enough figuring to make the problem of such a low-priced car extremely interesting.

The electric-car-buying public is somewhat critical. The present cars are built as they are, not because the manufacturer is trying to force prices higher and higher but because the demand is for more speed, more mileage, more expensive finish—not a car, but a house on wheels—and each succeeding year calls for more rather than less. Each year, also, the tire manufacturer is making his product a little less efficient as to miles per charge in order to get longer life. These requirements all cut in on the $120 at the disposal of the manufacturer of the car.

With a price ratio of ten to one existing between the most expensive and the cheapest of the gas cars, it is only reasonable that a five to one ratio should obtain among electric cars. A reaction seems to be at work now in that the gasoline car appears to be going toward a lower level of price and weight. This tendency may also come in the domain of the "electric," but it has not appeared as yet. When buyers will be content with a relatively low-speed, open car, with inexpensive finish, and when owners will not worry about an occasional squeak or rattle, then the cheap electric vehicle will be much nearer to us than it is at present.

JOHN H. HERTNER,

Cleveland, Ohio. *Rauch & Lang Carriage Company*

Compulsory Registration of Engineers

To the Editors of the Electrical World:

SIRS:—Under the provisions of the law passed by the Austrian government in 1913, compulsory chambers of civil engineers have been created. Every civil engineer must belong to the chamber of his own province and is subject to its disciplinary power.

In Austria the professional qualification of "civil engineer" is protected by law, the title being accorded only to graduates after five years' apprenticeship, followed by examination. Those inscribed on the civil-engineer roll are usually at least twenty-six to twenty-eight years of age, since they must have completed successively the primary school (admission not under six years of age), four years; middle school, seven to eight years; polytechnic, four to five years, and the apprenticeship, five years.

Civil engineers are entitled to use the imperial eagle in their seals, and technical documents signed by them are considered equally valid with those signed by state officials. Civil engineers in Austria are divided into eight classes, having to do with (1) railways, roads and waterways, (2) architecture, (3) mechanical engineering, (4) electrical engineering, (5) shipbuilding, (6) agronomy, (7) forestry, (8) industrial chemistry.

Since 1901 it has been possible for a graduate of a polytechnic school to take an examination and receive the degree of "doctor rerum technicarum," but as the preparation for this degree requires at least a year few applicants obtain it.

The compulsory chambers of civil engineers represent an entirely new feature of legislative support of graduates and will be a useful weapon of protection in the hands of civil engineers.

Trieste, Austria. DR. GINO DOMPIERI.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

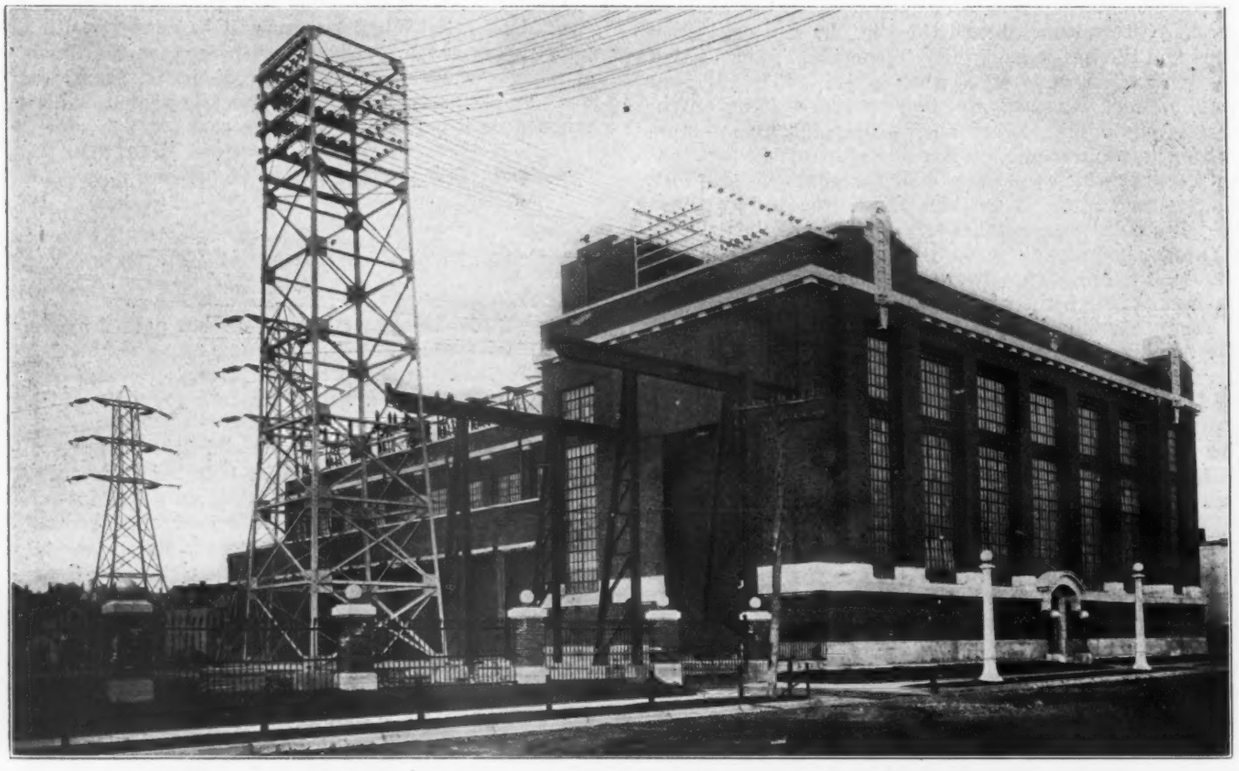
Operating Record of the Keokuk-St. Louis Transmission Lines

Officials of the Electric Company of Missouri, which distributes Keokuk hydroelectric energy in St. Louis and vicinity, are authority for the comment that the most interesting events connected with the operation of the 110,000-volt line between the Keokuk water-power plant and the Page Avenue substation at St. Louis are those which have not happened. With the line already in operation more than six months there has been only one interruption to the 110,000-volt service, and it may be added that this failure was not due to any fault of the apparatus. The mistake which left St. Louis without its "Keokuk service" for a few minutes was the result of a peculiar condition arising in the generating station.

At the time of the accident the two auxiliary water-wheel-driven generators which stand in the center of the station and furnish 440-volt energy for the motor-driven exciters were both in operation with one unit carrying all of the excitation load. Load was to be shifted from one of these machines to the other and an operator was sent to shut the gates on the idle machine. Unwittingly, however, he closed the gate of the alternator which was carrying the load, and the shutting down of this machine removed the field excitation from the main generators, interrupting the delivery of energy to the 110,000-volt lines.

Some of the rigorous treatment which the lines have withstood without interrupting service has shown the remarkable sturdiness of the transmission equipment. One Sunday morning a farmer with a new rifle proved his ability as a marksman by putting a neat hole through a string of insulators, letting one phase of the line down onto the street cross-arm. Although there was a reduction of voltage at the Page Avenue substation, the load was switched to the duplicate transmission line without interrupting service.

At another time an insulator supporting a wall-type disconnect switch broke down, but the load at this time was successfully transferred to the other line without difficulty, the line disturbance being hardly noticeable. During both of these latter accidents the steam plant of the Union Electric Light & Power Company at St. Louis remained in synchronism with the Keokuk plant.



THE ST. LOUIS TERMINAL SUBSTATION OF THE 110,000-VOLT KEOKUK TRANSMISSION LINE

The accompanying illustration shows the completed Page Avenue substation, the equipment of which was described in the *Electrical World* of May 31, 1913. Towers and roof structures for the 110,000-volt service are shown in the background of the picture, while in the foreground may be seen one of the two square towers carrying the 13,000-volt leads over which energy is distributed to the local electric-service companies.

Management of Oil-Fuel Plants

BY R. T. STROHM

The management of an oil-burning plant differs very considerably from the management of a coal-burning plant because of the rapidity with which any alteration in the rate of firing affects the generation of steam. With a coal fire the response to an increased rate of firing is slow, because it is necessary for the fresh fuel to become heated to the temperature of ignition before it can burn and give off heat. In the case of an oil fire, however, the combustion keeps pace with the rate of feeding the oil, so that an increased flow of oil is immediately followed by an increased generation of heat.

The fact that an oil-burning plant is so quickly responsive to alterations in the conditions of combustion makes it necessary to observe care in the regulation of the burners and the control of the air supply. It is particularly necessary to guard against the admission of too much air, which will dilute the products of combustion and cause loss of heat. A fireman accustomed to the use of solid fuel may find it difficult to learn to reduce the air supply sufficiently for the economic burning of oil, as oil requires a much smaller excess of air.

Starting an Oil Fire

The method to be used in starting an oil fire under a boiler will depend on whether the boiler is the only one in the plant or whether there are other boilers already under steam. If steam is not available from some auxiliary source, it is necessary to start an ordinary wood fire and get up steam pressure enough to atomize the oil. If the boiler is one that has been converted from coal burning to oil burning, and the grates are still in place, covered with firebrick, the wood fire is built right on the firebrick layer and is kept going until the steam gage on the boiler shows a pressure of at least 20 lb., which will be sufficient to atomize the oil for starting the fire. It is not necessary to remove the burner while this fire is under way, but the fire should be kept at a safe distance from the burner.

When the steam pressure reaches 20 lb. the oil-pressure pump should be started and the steam valve on the burner should be opened. Steam should be allowed to blow through the burner until the issuing jet appears to be dry. Then the oil valve is opened and oil is allowed to flow into the burner. The spray of oil will be directed into the wood fire on the floor of the furnace and will be ignited, after which the burner will continue its operation in the usual way. The wood fire may be allowed to burn out or it may be raked out after the oil fire has been started.

If there are other boilers in use, so that a supply of steam is at hand, the operation of starting an oil fire under a cold boiler is made much simpler and shorter. The first thing to do is to open the damper to its full extent. The steam and oil stop valves are kept closed, but the needle valve or oil-regulating valve is opened slightly. Now steam is admitted to the burner and is allowed to flow until the pipes and the burner are heated and the issuing current seems to be dry, which indicates that there is no condensation collected in the steam-supply system. Next, a bunch of waste saturated with oil should be lighted and placed inside the furnace, on the firebrick, directly in the path of the steam blast. Then the fire door should be closed quickly and the oil valve should be opened. The oil will flow though the partly opened needle valve or oil-regulating valve and the spray will be ignited by the burning waste. After the fire is thus started, the combustion may be regulated by adjusting the flow of oil and steam and by changing the air supply through manipulation of the ash-pit doors and the damper.

Before starting the fire, it is a wise precaution to blow steam through the oil side of the burner to make sure that the oil passages are clear. This is done by opening the by-pass valve and the steam valve. After the fire is started the intensity of the fire should not be increased too rapidly, as there is danger in forcing the fires under a cold boiler.

The condition of the fire is observed through peepholes that are placed in front of the setting or at the sides. When the boiler and its setting have become heated to the usual working temperature the interior of the furnace should appear to be filled with flame, the color of which should verge on a dazzling white. The flame should be steady and not surging or gusty. An experienced fireman can judge the condition of his fire very accurately by observing the color of the flame, but it is advantageous if he can also see the top of the chimney.

The combustion of oil is accompanied by a roaring noise, and the nature of this roaring also serves as a guide to the conditions existing in the furnace. It is noticeable that an excessive supply of cold air greatly increases the noise, and that preheating of the air supply renders the combustion much quieter. It is natural to suppose, therefore, that the reduction of roaring in the furnace is accompanied by an increased efficiency of combustion, since it is obtained by cutting down the excess of air and by increasing its temperature.

The formation of smoke may be traced to an insufficient supply of air, an oversupply of oil or too little steam to atomize the oil thoroughly. A burner that has not been properly cleaned and that is clogged or imperfectly adjusted will produce an unsteady flame and may cause smoke. If there are scintillating particles in the flame and they appear to fall to the floor of the furnace, it may be concluded that the atomization is imperfect. The pressure of the atomizing agent should therefore be increased. If there is water in the oil or in the steam, the burner will spit and act erratically. A similar sputtering may be caused by the presence of gases in the oil, due to an excessive heating of the oil on its way to the burner.

Regulating the Fuel Burners

In the average small plant using liquid fuel the burners are regulated by hand to accommodate the rate of firing to the demand for steam. This can be done readily because the number of burners to be adjusted is not great; but in a very large plant this method of control would be irksome, particularly if the load were subject to wide and frequent changes. With hand regulation of the separate burners the economy depends on the intelligence of the fireman in judging the conditions of combustion and in the quickness with which he adjusts the burners to changes of load.

Automatic regulation is employed in some of the larger plants. The means by which regulation is effected varies, but the end attained is the same, namely, an increase or decrease in the rate of firing to correspond to an increase or decrease of load. An increased demand for steam is evidenced by a decrease of steam pressure in a boiler. One system of automatic control therefore uses a regulating valve on the oil line to the burners. This valve determines the rate of flow of the oil, and its stem is attached to a spring and to a diaphragm that is acted on by the steam pressure. The pressure of the spring and the steam pressure act to oppose each other, and the tension of the spring can be altered to suit conditions. By setting this spring to the proper tension, any decrease of steam pressure following an increased load on the boiler will allow the spring to open the valve slightly and more oil will be admitted to the burners. In this way the rate of com-

bustion can be made to follow the demand for steam very closely. In this system the pressure of the oil as supplied by the pump remains constant.

In another system of automatic regulation the regulating valve takes the form of a pump governor. When an increase of load comes on, the governor admits more steam to the pump, which increases its speed and gives a higher oil pressure. The oil valves at the burners are left open, and the result of the higher pressure is an increased flow of oil. There is a greater amount of heat thus generated and the steam pressure is quickly brought back to normal by the accelerated evaporation. While the steam pressure is increasing the governor is gradually cutting down the speed of the pump. In this way the steam pressure is kept fairly uniform.

Of course, an increased flow of oil demands an increased flow of steam to atomize it properly. In the system of control just described the steam supply is regulated by a valve whose stem is fastened to a diaphragm acted on by the oil pressure. An increased oil pressure immediately causes an increased opening of the steam valve, and thus the correct ratio of steam to oil is maintained.

Draft

The draft required for the burning of oil fuel is very small, ranging from about ⅛ in. to ½ in. of water. This is much less than is required for the burning of solid fuels and is accounted for by the fact that in an oil-burning boiler the only resistance to be overcome by the draft is that due to the friction of the gases in passing through the furnace, among or through the tubes and along the breeching and the chimney to the outer air. In a coal-burning boiler the draft must not only overcome these resistances but must also cause the air supply to rise through the bed of fuel on the grates. For this reason the chimney of a coal-burning plant will give too strong a draft when the fuel is changed to oil, and to prevent the inrush of too much air the damper must be closed to a greater extent than when solid fuel is used.

The regulation of the air supply to the furnace may be effected either by means of the damper alone or by means of the damper and the ash-pit doors. When the damper alone is used, the ash-pit doors are left wide open and the rate at which air flows into the furnace is controlled by the amount of opening of the damper. The advantage of this system of control is that at all times there is ample opening for the admission of air and the air enters at a rate sufficient to replace the gases that escape to the chimney. By impeding the escape of hot gases at the damper the hot products of combustion are kept in contact with the boiler surfaces for a longer period and the rate of travel is reduced, thus giving ample time for complete combustion.

It is probable, however, that in the larger number of plants the regulation is accomplished by both the damper and the ash-pit doors. When the load on the boiler decreases the amounts of air and oil are reduced. This results in a corresponding reduction of the weight of gases formed in the furnace, and so the damper should be moved toward its closed position. When the demand for steam increases the opposite adjustment must be made. In any case, the object to be attained is efficient combustion, and this should be done with the least possible amount of air. To judge as to when this point has been reached, the air supply may be cut down until smoke is formed, indicating that there is too little air. Then the supply may be increased gradually until the smoke disappears and only a slight haze is visible at the top of the chimney.

When an oil-burning boiler is to be shut down, the stop valve on the oil line to the burners should be closed first of all, thus cutting off the flow of oil and stopping combustion in the furnace. Next, the steam valve should be closed until only a small jet of steam escapes from the burner. The oil side of the burner should then be blown out, which is done by opening the oil-regulating valve on the burner, the by-pass valve and then the steam valve. This precaution is necessary to prevent clogging of the burner; for if the oil is allowed to remain stagnant in the burner and its connecting pipes, the heat of the setting will carbonize the oil and bake its tarry constituents on the inside of the passages, and there will be trouble and delay when the burner is again put into service. The ash-pit doors and any other openings for the admission of cold air to the furnace should be closed and the damper opened, so that the setting may not cool too rapidly.

As a usual thing, the heat stored in the brick lining of the furnace will re-ignite the oil spray if the flow of oil is interrupted for a few seconds. If the supply of oil is cut off for some time, however, the temperature of the furnace may fall to such a point that the oil cannot be ignited by the heat of the firebrick. In such a case the fireman should shut off all oil and then close the steam valve, putting the burners out of action. Then he should throw a bunch of burning waste into the furnace, close the fire door and restart the burner in the usual way.

The inflammable nature of oil fuel renders accidental fires a possibility. Should oil escape from the pipes and become ignited, the flames should be smothered by scattering sand or earth over the surface of the blazing liquid. The air is thus shut off from the oil and combustion dies out because of the lack of oxygen. It is useless to attempt to put out an oil fire by turning water on it, because the only effect of the water will be to spread the oil without extinguishing the flame.

Home-Made Outfit for Thawing Water Pipes Electrically

A 20-kw, 2300/110-volt, pole-type transformer, 60 ft. of No. 10 wire, two outdoor-type fuse blocks with 15-amp fuses, 200 ft. of No. 00 stranded insulated wire

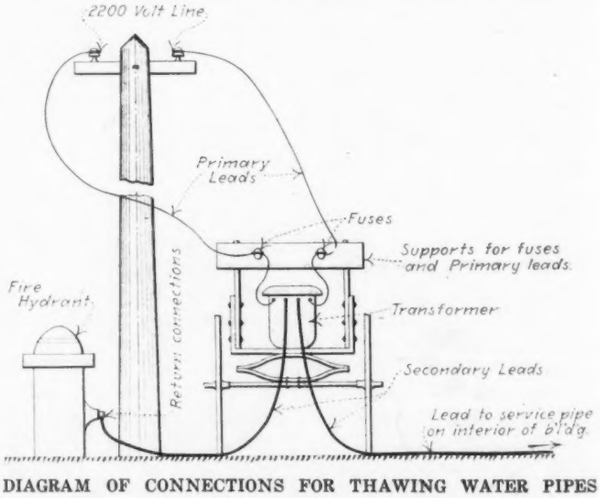


DIAGRAM OF CONNECTIONS FOR THAWING WATER PIPES

and a wagon on which the foregoing apparatus can be mounted comprise the necessary equipment for an emergency pipe-thawing outfit. In the past some companies have thought it advisable to use a 55-volt secondary for thawing, but results where both the 55-volt and 110-volt circuits have been tried show that current values with 110-volt secondary circuits do not rise

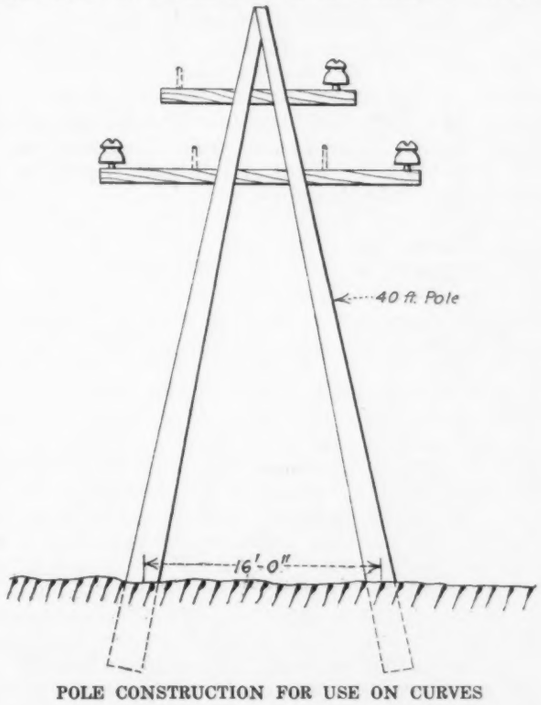
above 300 amp for ordinary service pipe. By mounting the transformer in the bed of a wagon and erecting a supporting frame of pine boards for the fuse blocks, using the No. 10 wire to connect the primary lines to the fuse blocks, making permanent connections from the fuse blocks to the transformer primary taps, and carrying the 200-ft. stranded cable for secondary connections, such an outfit can be put together by a force of linemen in a short time.

Water pipes generally freeze between the street main and the house-service valve in the basement of the building supplied, and the Illinois Northern Utilities Company, which has done considerable pipe-thawing work in Evanston and Oak Park, Ill., believes it always good policy to disconnect the pipe being thawed from the remainder of the water-works system. Disconnection eliminates the possibility of shunted currents which necessitate a longer period of thawing and create a possible fire risk. For an external connection to the house-service pipe a fire plug in the street may be used.

In cases where temporary thawing outfits have been equipped with electrical measuring instruments and current-limiting devices it has been speedily discovered that the latter were superfluous since the resistance of the ordinary service pipe alone keeps the current values well within the range of rating of a 20-kw transformer. As a rule, the current in the secondary circuit varies from 150 amp to 300 amp for ordinary iron pipe.

Pole Construction for Transmission-Line Turns

Pole construction similar to that shown in the accompanying illustration is being used by the Eastern Michigan Edison Company on curves on some of its transmission lines to withstand transverse stresses. Wooden



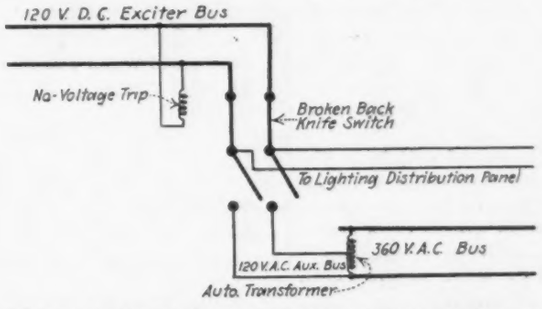
POLE CONSTRUCTION FOR USE ON CURVES

poles 40 ft. long are fastened together at their tops by a mitered joint, and two cross-arms are attached before the A-structure is raised. Only three insulator-pin positions are used on these frames at present, but six positions can be obtained for double-circuit lines by arranging the pins symmetrically on each side of the center line. The 16-ft. spread of the legs has been found satisfactory on 35-deg. turns where three No. 0 copper conductors are used and the poles are spaced about 175 ft. apart, and this construction can also be used on spans of 500 ft. or 600 ft. Mr. G. E. Lewis, of Ann Arbor, Mich., who is division superintendent of the company, is to be credited with inaugurating the use of this construction as well as the 1000-ft. span towers described in the *Electrical World* Dec. 13, 1913.

Emergency Lighting Service in Reserve Steam Plant

We have a railway steam generating station, which has recently been converted into a combined rotary-converter substation and reserve plant to operate in conjunction with a large hydroelectric system. The station lighting was laid out to operate on two-wire direct-current energy furnished by a steam-driven exciter, but when the main generating units are shut down and the plant is being operated as a substation it is, of course, uneconomical to run the exciter in order to carry only the station lamp load. To simplify our energy-exchange records, however, we prefer operating the lamps on the exciter circuit as long as the steam generating sets are in use, but would like to adopt a system whereby the lamps could be automatically thrown over onto the hydroelectric supply in case of emergency or when the steam plant is shut down. H. K. S.

You do not mention the voltage used on your electric railway, but, assuming that it is 625 volts direct current, the alternating-current potential impressed across the converter slip-rings would be about 360 volts. In



EMERGENCY LIGHTING SERVICE CONNECTION FOR RAILWAY CONVERTER STATION

such a case it would be simple to connect an auto-transformer across one phase of the alternating current bus and run 120-volt taps to an auxiliary bus for lighting. A double-blade broken-back knife switch can then be placed on the back of the exciter panel with its upper clips connected to the exciter bus, the lower pair to the auxiliary lighting bus, and the blade terminals to the lighting distribution panel. The switch can be equipped with a spring and a no-voltage trip which will cause the lighting circuit to be thrown over onto the auxiliary bus when the exciter bus is de-energized. This scheme should not be employed if any direct-current arc lamps are used.

Current for Three-Phase Motor

What is the approximate value of the line current required for a 10-hp 500-volt three-phase motor? A. M.

At full load a 10-hp motor of this type has an efficiency of about 84 per cent and operates at about 89 per cent power-factor. Since 1 hp equals 746 watts, the power taken by the motor under full load conditions will be $10 \times 746 \div 0.84 = 8880$ watts, or 8.88 kw. The current per line wire (I) in a three-phase circuit is expressed by the formula below, where E is the voltage, $\cos \theta$ is the power-factor and P the power in watts. Substituting, $I = P \div (1.73\, E \cos \theta) =$

$$8880 \div 1.73 \times 500 \times 0.89 = 11.51 \text{ amp}$$

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Temperature of Machines in Intermittent Operation.—L. ISAMBERT.—This article explains how with the aid of simple tests of a machine it is possible to calculate approximately the rating of the machine in intermittent operation. Under average conditions the rating in intermittent operation equals the rating in continuous operation multiplied by $\sqrt{1+1.6\,n}$, where n is the ratio of the period of rest to the period of work.—*La Lumière, Elec.*, Jan. 31, 1914.

Induced Emfs.—L. BARBILLION.—A mathematical article, being a supplement to his recent article on various forms of magnetic fields and the emfs induced thereby. The present article deals first with the definition of the "coefficients of reduction" of the fluxes and of the "coefficients of reduction" of the emfs. These coefficients are often used in workshops, but their definitions are not free from confusion. The author then compares the value of the induced emfs if the primary fields vary with the time or do not vary, and finally discusses the most general expressions of these emfs when the induction is not represented by sinusoidal functions of time and space.—*La Lumière Elec.*, Jan. 31, 1914.

Alternating-Current Generators.—B. G. LAMME.—In a second article on the engineering evolution of electrical apparatus a historical review is given of the development of the alternating-current generator in the United States with special reference to the work of the Westinghouse company. The subject is discussed under the headings of surface-wound armatures, toothed armatures, compounding alternators, introduction of polyphase alternators, the first Niagara alternators, influence of direct-current design, rotating-field generators, field construction and waterwheel-type generators.—*Elec. Journal*, February, 1914.

Three-Phase Repulsion Motor.—A. HEYLAND.—A brief article describing a three-phase repulsion motor which is claimed to be as simple as the single-phase repulsion motor and to have essentially the same properties as the three-phase series motor without its disadvantages and to be cheaper in construction on account of the simple rotor short-circuit and the avoidance of a transformer.—*Elek. Zeit.*, Jan. 22, 1914.

Generation, Transmission and Distribution

Reactance Coils.—E. P. HOLLIS.—An abstract of a paper read before the (British) Institution of Electrical Engineers. The author reviews the part played by inherent and added inductance in the phenomena that occur in electrical power circuits. He discusses how reactance may be usefully employed to solve certain engineering problems. These problems include the limiting of the excessive current that may momentarily flow in the case of a short-circuit and the increase in the stability of power systems so that they can better withstand internal disorders. It is explained why internal reactance cannot be relied upon solely in the case of a generator and why some of the needed reactance must be external. It is also explained why the benefits conferred upon a generator by reactance and reactance coils do not apply in the same way to a transformer. A few notes on suitable forms of reactance coils are added.—*London Electrician*, Jan. 30, 1914.

Electric Power in Cement Factories.—W. FUCHS.—An illustrated description of the hydroelectric installation of a Portland cement factory in Brasso, Hungary. This factory was formerly operated by steam, but water-power has now been developed, the plant containing two 550-hp turbines each connected to a 550-kva three-phase generator. Energy is generated at 15,000 volts for transmission to the factory. For transmission and distribution to a nearby village the pressure is reduced to 3000 volts. At the cement factory there is one large motor of 800 hp running at 125 r.p.m., as well as smaller ones.—*Elek. u. Masch.* (Vienna), Jan. 25, 1914.

Evolution of Apparatus.—C. F. SCOTT.—In the first article of a serial on the engineering evolution of electrical apparatus the author describes the beginnings of the alternating-current system in the late eighties.—*Elec. Journal*, January, 1914.

Traction

Electrification of Swiss Railways.—J. REYVAL.—The conclusion of his account of the report of the Swiss commission for the investigation of the electrification of the Swiss railways. It decides in favor of the single-phase system with series motors. In the present instalment an account is given of one of the projects which have been worked out. It relates to the electrification of the old Gotthard line.—*La Lumière Elec.*, Jan. 24, 1914.

Installations, Systems and Appliances

Rates for Residences.—H. H. SEABROOK.—An abstract of an address on the "ratable value" rate schedule for residences. The author is convinced that in the present state of the art the ratable value is superior to any other basis of primary charge, with the proviso that where the price of gas is not more than 62 cents per 1000 cu. ft. the secondary rate should not exceed 2 cents per kw-hr. It is adaptable to an almost universal application, because, although all undertakings cannot afford to take such a low percentage of ratable value as 10 per cent per year, they can take 20 or 25 per cent without affecting the principle, and a very large number can then afford to supply the energy used at 1 cent per kw-hr. (assuming gas competition at 62 cents). It is possible to regard the ratable-value system in two ways—first, to calculate the primary charge so that it covers investment costs and standing charges of the complete electric service to a residence, and that the secondary rate of 1 cent represents the running cost, plus profit, of the kilowatt-hours sold; secondly, the primary charge plus a few kilowatt-hours at 1 cent can be regarded as the charge for lighting the residence and the secondary element regarded as the charge for additional business from other uses than lighting. The objection is discussed that two residences of equal size may have very different ratable values brought about by their positions in the same locality, resulting in an apparently unfair difference in the amounts payable as primary charge. This objection is answered by the argument that the man who lives in the more expensive neighborhood will have more money and will therefore be better able to purchase a complete electrical outfit than the other man. For instance, whereas the man in a less expensive residence section may be content with electric light and a cooker and a few heaters, used intermittently, the

resident in the expensive section will want the complete service—light, heat and cooking—and will use it to the exclusion of other agents. For the same reason the cost of the units will be a smaller matter to him than to the other man. In arranging taxes of any kind it is a recognized practice that those who can pay shall pay.—*London Electrician*, Jan. 23, 1914.

Electrophysics and Magnetism

Skin Effect.—E. F. NORTHRUP AND J. R. CARSON.—A detailed discussion of the mathematical theory of the skin effect and alternating-current resistance. The authors give a complete mathematical investigation of the subject together with the results of a series of experiments. There are at least three important cases in engineering practice where the skin effect may play a prominent part: in third-rail transmission, in energy transmission by means of copper-clad iron conductors, and in the short and very heavy copper conductors which carry large alternating currents from the low-tension side of transformers to electric furnaces. The skin effect is almost wholly a phenomenon of the lines of induction on the interior of the conductor. It is, therefore, impossible to diminish it by subdividing the conductor into strands which lie close together or by giving to the return conductor a non-inductive disposition. It may, however, be diminished by disposing the material in the form of a tube or a sheet. The effect can also be greatly diminished by decreasing the permeability. Thus steel rails made of a certain composition are practically non-magnetic. Even though these show a higher ohmic resistance than ordinary steel rails, they might prove to be very much better carriers of alternating current. If it were possible to divide a conductor into many strands and then intermingle the strands of the return conductor with the strands of the outgoing conductor, the skin effect would be greatly diminished. This procedure might be applied in connection with electric furnaces. The skin effect is practically the main cause of the increase of the ratio of alternating-current resistance to the direct-current resistance in ferrous materials. But the hysteresis of the iron must also play a small part in increasing the ratio.—*Journal Franklin Inst.*, February, 1914.

Supposed Chemical Decomposition of Varying Magnetic Fields.—In 1908 I. Rosenthal presented to the Berlin Academy of Science an account of some experiments, according to which complex molecules like starch, when dissolved in water, seemed to be changed into the simpler molecules of fruit sugar (fructose) when acted upon by varying electric fields of certain periodicities. The solutions were placed in beakers surrounded by solenoids, and Rosenthal stated that the induced currents or fields had to be of certain periodicity. Under ordinary conditions the solution would become warm when the currents were turned on, while at a certain characteristic periodicity the substance would not become hot but break down into simpler compounds. Rosenthal has not published any continuation of these remarkable experiments, but two refutations appeared last summer. The first, by R. Cegielskij, was presented to the Deutsche Physikalisch Gesellschaft; the second and more complete paper was contributed by George W. Heimrod, of the New York Rockefeller Institute of Medical Research. The latter made his experiments—or, rather, this second series of them—in the Hanover Technical High School under Bodenstein. He took a Wehnelt interrupter consisting of a quartz tube drawn out to a capillary and through which a platinum wire passed and kept this apparatus working at from 200 to 900 interruptions per second of a current of 10 amp for several days. Ordinary apparatus would not have stood this. In all cases he conducted two parallel experiments, one with the high-frequency treatment and a check experiment without any electric treatment. The results were in all the pairs the same at temperatures ranging up to 90 deg. The starch remained starch, or a slight percentage of sugar was formed when additions of electrolytes were made to the starch; but that percentage of sugar was the same in the electrically treated and in the untreated starch. The additions were sodium chloride, hydrochloric acid, phosphoric acid, acetic acid and diastase—the acid and diastase effect on hydrolysis which leads to sugar formation. Thus Rosenthal's experiments, which appeared very remarkable, though they hardly could have an analogy in the household of nature, remain unconfirmed. Rosenthal, in fact, himself failed in repetitions of his experiments. He experimented with other compounds besides starch and found different characteristic periodicities for different compounds.—*Zeit. f. Elektrochemie*, Oct. 15, 1913; noticed in London *Engineering*, Jan. 16, 1914.

Theory of Relativity.—G. DIMMER.—A concise review of the fundamental principles of the theory of relativity, giving a sketch of Michelson's experiments, Lorentz's transformation equations, Einstein's principles of relativity and Minkowski's scheme of giving a picture of the world in a four-dimensional space with three axes of space, the fourth axis (the "world axis") being that appertaining to time.—*Elek. u. Masch.* (Vienna), Jan. 25, 1914.

Electrochemistry and Batteries

Electrolytic Corrosion of Iron in Soils and Destruction of Pipes by Stray Currents.—BURTON MCCOLLUM AND K. H. LOGAN.—An account of an investigation describing the arrangement of the experiments and discussing the factors which affect efficiency of corrosion and the factors which affect earth resistance. The conclusions are as follows: The current density has a marked effect on efficiency of corrosion of iron in soils, the efficiency of corrosion being in general greater the lower the current density. In saturated soils the corrosion may vary between 20 per cent and about 140 per cent for the range of current densities between 5 milliamp and 0.05 milliamp per sq. cm. Moisture content in the soil also has a marked effect on efficiency or corrosion, the corrosion efficiency being in general greater with increasing moisture content up to saturation of the soil. Beyond this point increased moisture content has comparatively little effect. Temperature changes within the limits commonly met with in practice have no important effect on corrosion efficiency. The depth of burial of pipes has no direct effect on corrosion efficiency provided other conditions remain constant. In practice, however, the moisture content, current carried by the pipes and various other factors which affect corrosion efficiency will vary with depth, so that indirectly difference due to depth may be noted. The amount of oxygen present has no appreciable effect on the efficiency of corrosion in the case of iron immersed in liquid electrolyte. Corrosion efficiency of iron embedded in earth is always greater in open vessels than in sealed vessels. The amount of oxygen present has a marked effect on the end products of corrosion. If the corrosion is rapid and the supply of oxygen small, there will be a preponderance of magnetic oxide, while if the rate of corrosion is low and the supply of oxygen abundant the ferric oxide will predominate. Owing to the fact that the supply of oxygen around pipes buried in earth is always more or less limited, the character of the oxides formed gives some indication as to the rate of corrosion, and thus indirectly the cause of the corrosion, if local conditions are properly considered. There is no material difference in the efficiency of corrosion shown by the various kinds of iron commonly used in the manufac-

ture of underground pipes. The fact that a given chemical tends strongly to inhibit either self-corrosion or electrolytic corrosion in liquids is no indication that it will materially retard electrolysis of iron embedded in soils. Pitting of iron embedded in soils is affected not only by a non-homogeneous condition of the iron or soil, but also by the chemicals contained in the soil. The efficiency of corrosion was found not to be a function of the voltage except in so far as the current density may be affected. Pressures as low as 0.1 volt and 0.6 volt showed practically the same efficiency of corrosion as those of 5 volts to 10 volts or higher. Corrosion tests on a large number of different kinds of soil from widely different sources with average moisture content and moderate current density indicate that corrosion efficiencies between 50 and 110 per cent may usually be expected under most practical conditions. The resistance of soils varies throughout a very wide range with variations in moisture content, the resistance of the comparatively dry soil being of the order of several hundred times the resistance of the same soil at about saturation. Above saturation increase in moisture content has but little effect on the resistance of the soil. Because of the great variations in resistance of earth with moisture content, voltage surveys should not be made at times when the earth is extremely dry. The resistance of the soil varies greatly with temperature within the ordinary range encountered in practice. In the case of the soil tested the resistance at 18 deg. below zero C. was over 200 times as great as at 18 deg. above zero C. Even at about freezing temperature the resistance will be several times that at summer temperatures. This not only has an important bearing on the magnitude of the electrolysis trouble that may occur at different seasons, but it also indicates that practical voltage surveys should not be made when extremely low temperatures prevail. The experimental results given in this paper have an important bearing on the subject of electrolysis mitigation through the limitation of voltage drop in the negative return. For some years the chief means of preventing trouble from electrolysis in certain foreign countries has been the limitation of the permissible voltage drop between any two points on the return circuit. In some places the limit has been placed on the maximum voltage during peak load, whereas in other cases the average voltage for twenty-four hours has been the determining factor. It will be evident that if the total amount of damage which results is proportional to the average current, then the limitation of the average voltage would be more logical than the limitation of the peak-load voltage, since in the former case the cost of meeting the voltage limitation in any case would be proportionate to the danger involved irrespective of the station load-factor. On the other hand, if the voltage at peak load is the determining factor the cost of complying with the requirements depends not only on the danger involved but on the load-factor of the system, and the poorer the load-factor the greater its cost will be. It appears from the data presented in this paper that the rate of damage does not increase as fast as the voltage increases because of the tendency toward lower corrosion efficiencies at higher current densities. This indicates that with a given average all-day current the actual amount of electrolysis that would occur would be less with a bad load-factor than with a good load-factor, and hence points to the undesirability of penalizing a high peak of short duration. It would appear more logical, therefore, in so far as the damage itself is concerned, to make the average all-day voltage the basis of the limitation rather than the voltage at time of peak load.—*Technologic Papers, United States Bureau of Standards*, Nov. 25, 1913.

Units, Measurements and Instruments

Measuring Idle Volt-Amperes.—H. B. Taylor.—The reason why some station operators prefer instruments which indicate the wattless component rather than the power component of an alternating-current circuit is a psychological one. At fairly high power-factors the wattless component of a given load is large as compared with the difference between the per cent power-factor and 100 per cent. For instance, 97 per cent power-factor really means practically the same thing as 25 per cent wattless factor. There are two instruments for indicating the components flowing in the circuit; one is the wattless-factor meter, and the other the power-factor meter. No essential difference exists between the two except the scale marking. The wattless-factor meter indicates zero when the power-factor meter indicates 100 per cent. A wattless-component meter indicates the total wattless component of the volt-amperes in the circuit, regardless of the power-factor, in the same way that the wattmeter indicates the total power component. It differs from a wattmeter only in the way it is connected to the circuit. This type of meter has the advantage of giving a more emphatic indication when the circuit is heavily loaded, coupled with the disadvantage that its indication is liable to escape attention at relatively small loads. Methods of making the connections of this type of meter are described.—*Elec. Journal*, February, 1914.

Analysis of Periodic Waves.—L. W. Chubb.—An article illustrated by diagrams discussing the Fourier or harmonic series, harmonic analysis and mechanical analyzers. A new mechanical analyzer is described which is adapted to work from a cut-out templet or grooved record of a polar curve printed directly from a polar or circular oscillogram. The accuracy and value of the machine are emphasized. Problems which take days to analyze by former methods can now be worked out with greater accuracy in as many hours.—*Elec. Journal*, February, 1914.

Measurement of High Potentials.—C. E. Guye and A. Tcherniawsky.—An illustrated article on an electrometer employing compressed carbonic acid gas at 4 to 10 atmospheres for the measurement of high potentials.—*Archives des Sciences Phys. et Nat.*, 1913; *La Revue Elec.*, Jan. 16, 1914.

Temperature Measurements of Electric Machines.—O. W. A. Oetting.—After a discussion of the effective temperature in electrical machines, the author discusses the methods of temperature measurements by means of thermometers, rise of resistance, resistance exploring coils, and thermocouples.—*Elec. Journal*, February, 1914.

Telegraphy, Telephony and Signals

Non-Uniform Telephone Lines.—Devaux Charbonnel.—The author has formerly shown how it is possible to determine by experiment without complicated calculations the constants of propagation of wave transmission over homogeneous lines. After determining the characteristic constant it is sufficient to measure the values of the currents at the transmitting and receiving ends, the line being closed through an impedance equal to the line characteristic. The author shows now that the same method is applicable to non-uniform lines and that the method of experimenting is not any more complicated.—*La Lumière Elec.*, Jan. 24, 1914.

Use of Telegraph Lines for Long-Distance Telephony.—Bela Gati.—The first part of a paper in which the author discusses the difficulty of separating telephone currents from telegraph currents at the present day, owing to the higher speeds that are used in telegraphy and the fact that dynamos for generating telegraph currents give rise to high-frequency currents due to commutation. He discusses the improvement of conditions

(1) by means of Pupin coils, (2) by means of earth-shunted conductive coils, and (3) by decreasing the effective resistance and leakage of the lines.—London *Electrician*, Jan. 16, 1914.

Electrolytic Detectors.—PAUL JEGOU.—The conclusion of his illustrated article on the electrolytic detector. The action is considered as a case of depolarization of an electrode. The author has formerly described an electrolytic detector which is capable of detecting the waves with a high degree of sensitiveness without the use of any external source of current. This detector

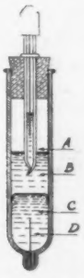


DIAGRAM OF ELECTROLYTIC DETECTOR

differed from ordinary detectors only by an inactive electrode which consisted of tin amalgam. The author has now found that the use of zinc amalgam gives much better results. The construction is shown in the diagram. *A* is the active electrode point, *B* is concentrated sulphuric acid, *C* is zinc amalgam and *D* is a platinum electrode (the latter two representing the inactive electrode).—*La Lumière Elec.*, Jan. 24, 1914.

Book Reviews

LABORATORY MANUAL: DIRECT AND ALTERNATING CURRENT. Prepared to accompany Timbie's Elements of Electricity. By Clarence E. Clewell. Published by the author at New Haven, Conn. 100 pages, 27 illus. Price, $1.

An elementary textbook of laboratory exercises in an electrical-engineering course. Thirty laboratory experiments are formulated and described, of which twenty involve direct-current supply and ten alternating-current supply, including single-phase and three-phase supply. The style is extremely simple and the treatment diagrammatic. Although designed for college students, the book might also prove serviceable in the laboratory instruction of evening schools and vocational schools for lads of high-school grade.

INSULATION AND DESIGN OF ELECTRICAL WINDINGS. By A. P. M. Fleming and R. Johnson. New York: Longmans, Green & Company. 102 illus. Price, $2.25.

On account of the importance of sufficient and durable insulation on electrical machines, the study of the properties of insulating materials and the best methods of utilizing these materials in the design of electrical machinery deserves more attention than it has received in the past. The use of higher voltages and the increased importance of insulating problems have led of recent years to a more thorough study of dielectrics; but the published results of this scientific research work are scattered and not always readily obtainable. A treatise on insulation and the design of electrical windings is therefore to be welcomed, even if it should do no more than bring together in a single volume the results arrived at by various workers in this field. The subjects dealt with in the book under review include a study of the physical characteristics of dielectrics; an account of the insulating materials of practical utility; the theory of electrostatic stresses leading to the correct design of insulation and the arrangement of windings in rotating machinery and transformers; insulation tests; the drying and handling of electrical windings, and the causes of insulation failures. These subjects are not treated exhaustively, but the numerous references to scientific papers and other sources of information will be found very useful to those who wish to pursue the matter further. Without altering the character or scope of the book, it is possible that some of the subjects dealt with might have been treated more fully with advantage. On referring to the index, the practical designer may not always find what he is seeking. As an instance, the causes of pressure concentration leading to breakdown of insulation between the end turns of inductive windings do not appear to be referred to, but the phenomenon is briefly discussed on page 49 and again on page 162. This is one of the problems which might be expected to receive a more thorough treatment in a book of this nature. In Fig. 4, on page 10, the pressure should be read as kilovolts, not as volts. A commendable feature of the book is the summary of the standard insulation tests as applied in Germany, America and Great Britain.

WIRELESS TELEGRAPHY AND TELEPHONY. By Charles R. Gibson. Philadelphia, Pa.: J. B. Lippincott Company. 156 pages, illus. Price, $1.

This book is intended to teach to persons of no scientific experience the theory, growth and present condition of radio signaling. While the arrangement and development of the subject is interesting, the author has not avoided the inaccuracies which are usually frequent in "popular science" works of this sort. Statements which imply that the period of an oscillating circuit is altered in practice by changing its resistance occur at two points, and some very shaky analogies are given. The book is rather more ambitious than the average primers of applied science in its attempts to present fundamentals. The electronic theory of electrical actions is the subject of a chapter, and some conception of it should be secured from a study of the book by a lay reader. It appears that to explain completely the entire history of ether communication from Faraday and Henry to the British "Imperial Wireless Chain," together with the principles underlying electrical phenomena, is too big a contract for 156 pages. The author has, however, picked out and presented much of the pith of the subject and quotes some interesting paragraphs from the technical and public press. A number of excellent photographs are shown, but it is unfortunate that all are of one general type, when there are available others of equal interest and instructive value. Although the publication is dated 1914, modern American radio practice is not treated at all; and, while the Goldschmidt generator is briefly described, there is not a word on "solid rectifiers" as detectors. Thus it will appear that the book is not especially well balanced, but there is in it, nevertheless, a quantity of material which should be interesting to its readers. If in studying it one will not permit the writer's abrupt style and occasional lack of grammatical care to distract him, and will not insist upon absolute accuracy in the treatment of recently developed instruments and methods, he should gain a fairly good idea of the elements and history of wireless. The numerous inventors are treated quite impartially, and though brevity has apparently forced out discussions of many important steps in the art's development, the history of the early and middle years of radio signaling is really excellent.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Primary Switch-Type Pole Cut-out

A switch cut-out and fuse designed for the control and protection of overhead lines for currents as high as 150 amp and pressures up to 2600 volts is being manufactured by the Metropolitan Engineering Company, Brooklyn, N. Y. The cut-out is constructed of heavy porcelain finished in brown, and it is made weatherproof for service on cross-arms. Each conductor is held in position in the terminals by two screws which prevent the loosening of connections due to possible pole vibration. The live parts are amply recessed and protected, thus making the liability to shock small. The fuse, as shown in the accompanying illustration, has a tapped base and is held in place on the end of the switch handle by a coarse-thread screw. A square

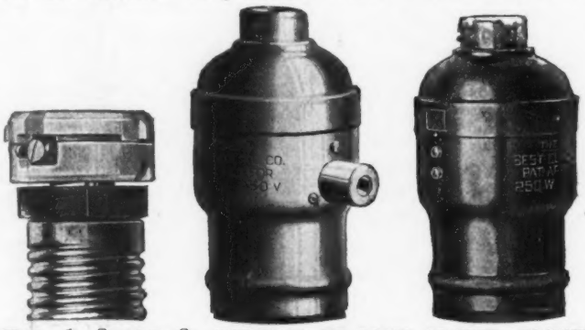
SWITCH CUT-OUT

shoulder on the fuse handle prevents the fuse or handle from loosening while in service. The height of the device with the fuse and handle is 14.5 in. and without it 8.5 in.; its width is 6.5 in. and its depth 5 in.

Lock Sockets

The Best Electric Company, Pittsburgh, Pa., has put on the market a lock socket which is designed to prevent the theft of lamps. Fig. 1 shows the interior of the device. Shoulder plates and a small plunger make it possible to turn the lamp firmly into the socket; but when turning the lamp in the opposite direction, as unscrewing it, the base rotates and holds the lamp so that it cannot be removed. In order to replace a lamp it is necessary to break the bulb. After knocking off the glass at the base, the outer brass shell of the bracket should be removed, and then by holding the rotating part of the lock the old base can be taken out. After replacing the outer shell, the new lamp can be inserted in the usual manner.

Fig. 2 shows a socket fitted with a special key release attachment. Sockets are also provided with key switches. Fig. 3 shows a keyless socket. These sockets are finished in polished brass unless otherwise



FIGS. 1, 2 AND 3—INTERIOR OF LOCK SOCKET, SOCKET WITH KEY RELEASE AND KEYLESS SOCKET

specified. Porcelain and weatherproof composition sockets are furnished with key switches if desired but not with key release attachments.

Electric Tractors in Municipal Service

Electric tractors are being employed in a variety of ways to eliminate the mule and the horse. Among these interesting applications is the 5-ton apparatus illustrated herewith, which is used by the city of New York and is shown hauling 7.5 tons of sand. Its wheelbase measures 74 in. and the frame is made of 6-in. channels. The long body was built by the city and de-

ELECTRIC TRACTOR USED BY CITY OF NEW YORK

signed for moving garbage, refuse, etc.; but the tractor proved so much more efficient than horses that this work was not enough to keep the machine in operation full time, and as a result it has been used to haul sand, cobblestones, etc. The tractor illustrated was built by the General Vehicle Company, Long Island City, N. Y.

Mercury-Motor Watt-Hour Meters

The mercury-motor watt-hour meter, like all motor meters, consists of a motor-generator set coupled to a revolution-recording mechanism, the speed of the set being proportional to the power delivered through it. The mercury motor consists essentially of a copper disk floated in mercury between the poles of a magnet and provided with leads to and from the mercury at diametrically opposite points.

The Sangamo Electric Company, Springfield, Ill., has developed a meter of this type, the complete motor element of which, including the damping disk, is built up into one compact unit which is held firmly in accurate position by three screws fastened to lugs cast with the base.

Fig. 1 shows a two-wire, direct-current watt-hour meter with the case removed. The damping disk and the motor disk are carried on the same shaft, which extends from the lower ring bearing up through the mercury chamber to the top bearing. The mercury is kept from spilling by a long tubular sleeve which surrounds the shaft, with a clearance of only 0.006 in. The motor element carries the recording train.

Meters for use on circuits of more than 130 volts are provided with resistors connected in series with the potential magnet windings, and these resistors when used in meters for circuits not exceeding 250 volts are mounted upon and form a part of the motor element. On circuits of more than 250 volts the series resistor is mounted in an external box.

A reversible thermocouple is used for compensation of friction on light loads. The couple with its heating winding is made very small and compact and is arranged so that it can be changed easily from positive to negative and vice versa by reversing the couple and without disturbing any of the meter connections.

The lower end of the shaft is held in its correct position by a ring jewel fastened permanently in the bottom of the mercury chamber, which is a special non-magnetic high-resistance alloy stamping thoroughly enameled. The upper end of the shaft is provided with a long split sleeve of brass that has the worm cut on

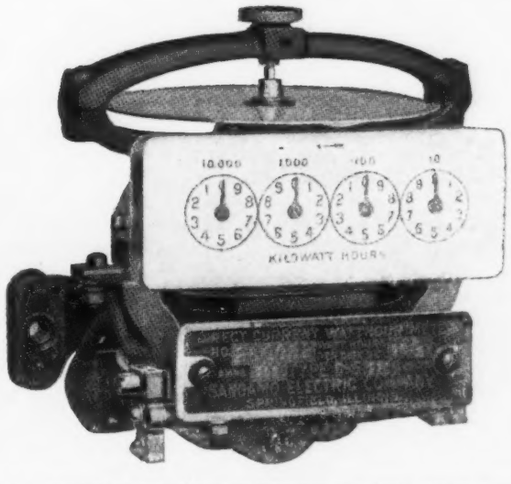


FIG. 1—COMPLETE MOTOR ELEMENT OF TWO-WIRE DIRECT-CURRENT METER

its lower extremity. At the upper end it carries an accurately ground and highly polished steel pivot. The sleeve pivot and worm can easily be removed if necessary and replaced by a new one without disturbing any other adjustments of the meter. This sleeve also carries the damping disk, which is effectively insulated from it with large heat-resisting insulating washers and a tube of the same material.

The hub of the damping disk is fitted with two set screws that serve the double purpose of holding the disk firmly in its proper position on the worm sleeve and of clamping the latter (which is split longitudinally) securely to the shaft. The motor field magnet is

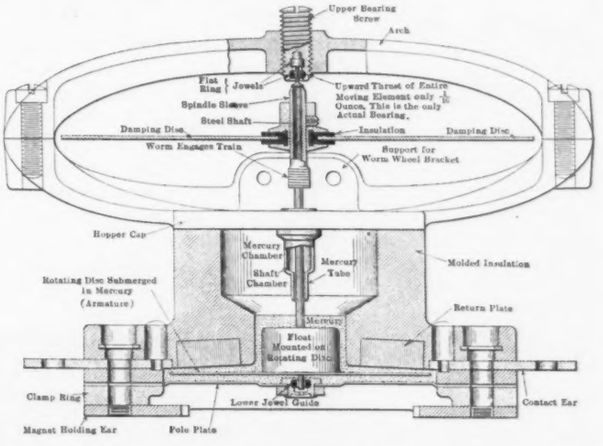


FIG. 2—CROSS-SECTION OF TWO-WIRE, DIRECT-CURRENT METER WITH RECORDING MECHANISM AND FIELD AND DAMPING MAGNETS REMOVED

built up of laminated high-permeability iron and energized by a pair of coils wound with fine enameled copper wire. The windings are arranged for connection across the line in series with the heater winding of the thermocouple. For pressures above 130 volts a resistor is connected in series with the magnet winding.

The magnet structure is clamped to the base of the mercury chamber by two punched ears that engage with slots in the laminated core and are securely bolted into slots milled into the bottom of the bracket ring which supports the mercury chamber. The bottom of the chamber or "pole plate" is stamped from special alloy metal. At its center it carries the lower ring jewel bearing which is permanently fixed in place.

The upper part of the mercury chamber is made of molded insulating material in which is embedded a circular ring of laminated electrical sheet steel wound edgewise under heavy pressure, this ring or return plate completing the magnetic circuit of the shunt magnet. The lower side of the molded chamber is accurately drilled and doweled to correspond with the pole plate and clamp-ring bracket on which the chamber rests. The mercury chamber is clamped securely to the bracket by six screws.

The permanent magnets which furnish the damping field are each supported on four brass posts riveted into the iron base of the meter. They are held in position by brass clamps that permit accurate initial adjustment of the magnets both with reference to each other and to the motor element. The main speed of the meter is adjusted by a magnetic shunt consisting of a soft-iron disk mounted on a fine-pitch screw. The shunting effect may be gradually and smoothly varied over a wide range by turning the disk up or down in a threaded boss that is cast into the base.

The dial train is so designed that the main part which gives successive decimal reductions for the several circles is exactly the same for meters of all capacities. The train is installed on a pressed-brass bracket and held by two small levers. By drawing the levers up to a vertical position they are disengaged from the supporting bracket and the train can be easily removed by sliding it forward.

In the three-wire direct-current meter two mercury motors are coupled together, and they drive a generator or damping disk, the revolutions of which are recorded in the usual way.

Current-Limiting Reactance Coil

A current-limiting reactance coil of new design has been put on the market recently by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The coil, as shown in the illustration, is of the air-core type, no magnetic material being used. The windings consist of a number of fine-stranded bare copper cables arranged in multiple. The use of multiple cables gives a greater surface with a given cross-section, resulting in low operating temperatures. The fine stranding reduces eddy-current losses to a minimum.

By placing the windings radially in disk-shaped layers the electrical stress between the layers is kept very low. By the same method of winding the length of each of the parallel cables is made the same, thus giving equal resistances. As each cable is in the same field, the equal inductances accomplish complete elimination of circulating currents.

A feature of the coil is the absence of heavy supports either inside or outside of the conductors. The conductors and the cleats separating the conductors are placed in such a way that the copper is put in tension and acts against the stresses radially outward while the cleats are put in compression against the stress in a line with the axis of the coil.

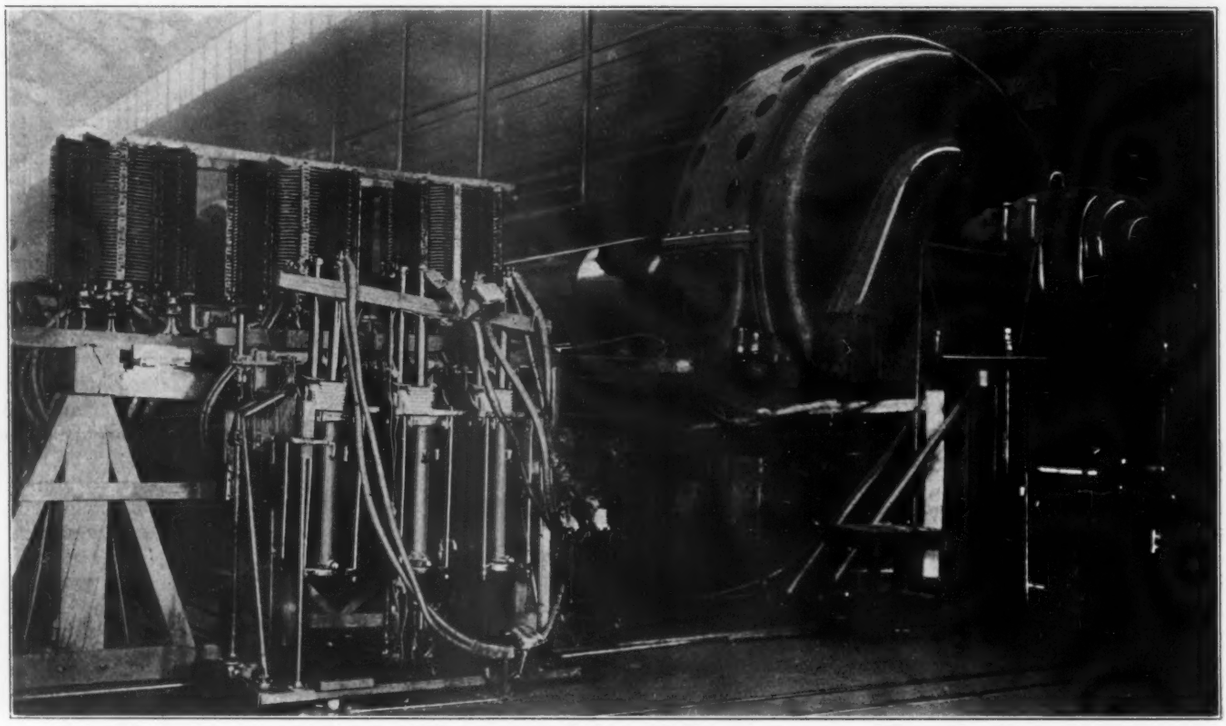
These coil supports or cleats are made of a special molded material and are non-inflammable. The supports have a high insulating quality and can withstand high temperatures.

The cables at one end are connected together and are brought to a terminal at the top of the coil, and at the other end to a terminal at the bottom of the coil. Duplicate terminals are provided at the top and bottom of the coil, so that, if desired, connection can be made from either the top or bottom through the center of the open coil. The absence of internal or external supports reduces the weight of the apparatus to a minimum and simplifies greatly the work of installation. The open construction allows a free circulation of air. The complete coil is mounted on insulators which are provided with special top castings of non-magnetic material.

As a test, a 16,700-kva, 8800-volt generator of recent design, running at full speed and without resistance or any other protection in the circuit, was short-circuited. Oscillogram records showed that a current of 21,000 amp, or twelve and one-half times greater than the normal, flowed through the generator. With generators designed some years ago such a test would have wrecked the machine, but in this instance no damage whatsoever was done. The only visible effect was a static flash between the field and the armature.

The test was performed to prove the fact that generators are now being built which require no protection from outside short-circuits, the apparatus itself being designed to be self-protecting. Unless the generator is properly constructed, a complete short-circuit tends to tear out the armature coils, which, when coming into contact with the revolving field, will cause considerable wreckage. The static flashes, furthermore, which always occur under such circumstances will destroy inferior insulation. With generators of the type tested, however, both results are guarded against by firmly securing the armature coils and bracing their ends, on one hand, and by the use of mica insulation, on the other. In consequence, even so severe an ordeal as this test was undergone without harm, although it was repeated a number of times.

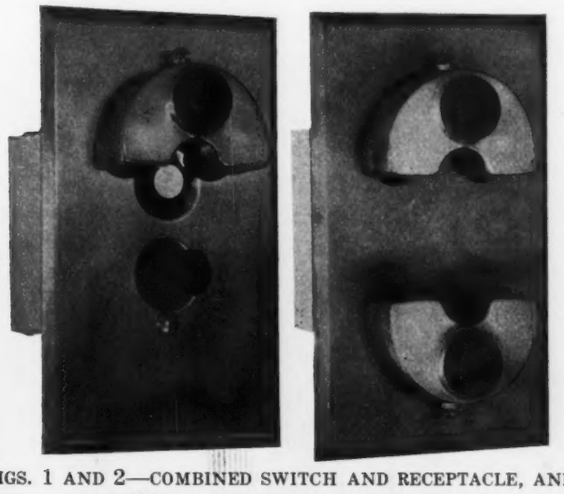
Several other tests were made in order to prove the reliability of circuit-breakers and reactance coils for protecting the feeder circuits. The generator was repeatedly short-circuited through these devices, which stood up well under the enormous stresses to which they were subjected.



AIR-COOLED TYPE REACTANCE COIL

Combined Switch and Receptacle Outlet

The combined switch and receptacle shown in Fig. 1 is equipped with a detachable mechanism and an outside attachment plug. The outer box is made with contact pieces on the inside, on the ends of which binding screws are provided. The box is put in the wall and the wires are permanently connected to the binding screws. The mechanism is made entirely separate from the outer box; it has spring contact pieces, however, which engage with the contact pieces of the outer box when the mechanism is slipped inside. The device when wired for double-pole operation may be used as a switch and receptacle outlet simultaneously. If the



FIGS. 1 AND 2—COMBINED SWITCH AND RECEPTACLE, AND RECEPTACLE WITH TWO OUTSIDE PLUGS

plug mechanism is inserted with the receptacle contacts on the live side, the tap-off circuit is independent of the switch; if on the dead side, the switch will control both through and tap-off circuits. The plate is made solid. Fig. 2 shows a receptacle having two outside attachment plugs and no push-button switch.

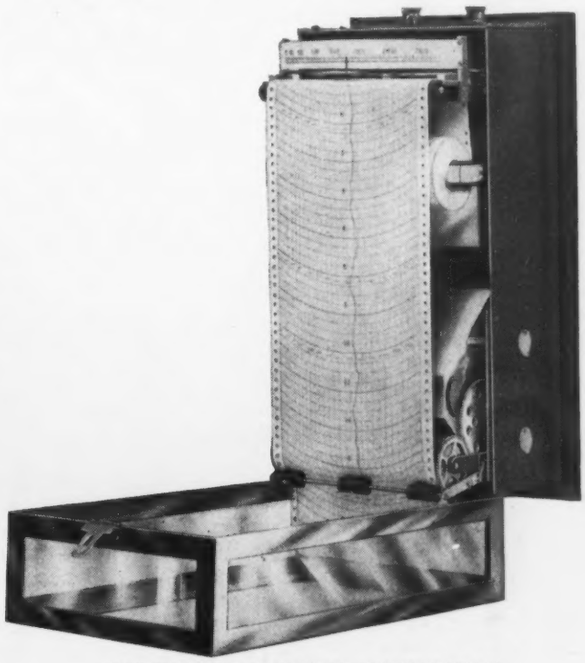
These receptacles are the product of the Metropolitan Electric Manufacturing Company, Long Island City, N. Y.

Continuous-Chart Recording Instrument

The Brown Instrument Company and the Keystone Electrical Instrument Company, of Philadelphia, Pa., are placing on the market a continuous recording instrument for use as an electrical pyrometer for recording temperatures and also as a recording voltmeter or ammeter. Efforts have been made in the design of this instrument to produce a device simple in construction and of the most compact form possible. The case of the instrument is 15 in. high and 8 in. wide and projects from the switchboard or wall 7 in. The space occupied has been made small by placing the clock mechanism behind the record chart instead of at one side, the record chart being the only part shown on the face of the instrument.

A two-month roll of record paper is used, which can be supplied with ink ribbon to make a dotted ink record, or the record can be made on coated paper. It is necessary to wind the clock once a week. In Fig. 1 is shown the complete instrument with a ten-hour record on the chart. One scale is placed above the record so that the indications are clearly visible at all times, and the paper has the scale printed on it for direct reading. In Fig. 2 the instrument is shown with the door open, and the interior construction can be clearly seen. This case need be opened once every two months only to renew the roll of paper.

Such a continuous recording instrument, it is pointed out, will prove advantageous for use as an electric pyrometer in conjunction with thermocouples, or as a resistance thermometer for measuring low temperatures, and also for recording voltages or currents. As

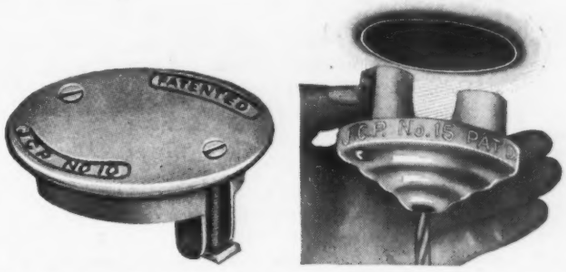


CONTINUOUS RECORDING INSTRUMENT

the d'Arsonval type of direct-current instrument of the frictionless type is used to prevent lag in the readings, a very sensitive and accurate instrument is secured.

Outlet-Box Fittings

Fittings that can be readily attached to ordinary outlet-box covers, when plastered in the ceiling, without breaking the plaster have been designed and put on the market by Mr. James C. Phelps, Springfield, Mass. Each of the devices is attached to the cover by two stove bolts, the nuts of which work in channels extending into the box. The lower ends of the channels are



FIGS. 1 AND 2—IRON COVER, AND METHOD OF INSERTING ROSETTE FITTING

inclined backward toward the center of the fitting and allow the nuts to be held in with the thumb and finger while inserting the fitting into the box, as shown in Fig. 2. When the screws are tightened up the nuts ride out on the inclined places in the channels and engage the inner edges of the box cover, thus fastening the device securely to the box.

Fig. 1 illustrates an iron cover for closing an outlet box not in use. Fig. 2 shows a rosette made of white-glazed porcelain for attaching a pendent cord to an open outlet-box cover plastered into the ceiling. In Fig. 3 is shown a galvanized-iron cover which is drilled for

FIGS. 3 AND 4—COVER FOR SWITCHES AND SOCKETS, AND COVER WITH FLUSH RECEPTACLE

taking surface switches, wall sockets, etc. The cover shown in Fig. 4 is fitted with a flush receptacle and is made of galvanized iron.

Electric Range

The Simplex Electric Heating Company, Cambridge, Mass., is manufacturing a number of different types of ranges in sizes suitable for families of from two to ten persons. The range shown in the illustration has a top 21.5 in. wide and 27.5 in. long, and when full heat is turned on the total power consumption is 4515 watts. Raised above the top surface about 3 in. (to allow for cleaning) are three disk stoves, two of them 6 in. in diameter and one 8 in. in diameter, for large and small cooking utensils, and also a broiler with a removable griddle top.

The disk stoves, the broiler and the oven are each heated separately, and the temperature is controlled in three degrees (high, medium and low) by switches clearly marked and easy of access on the front of the

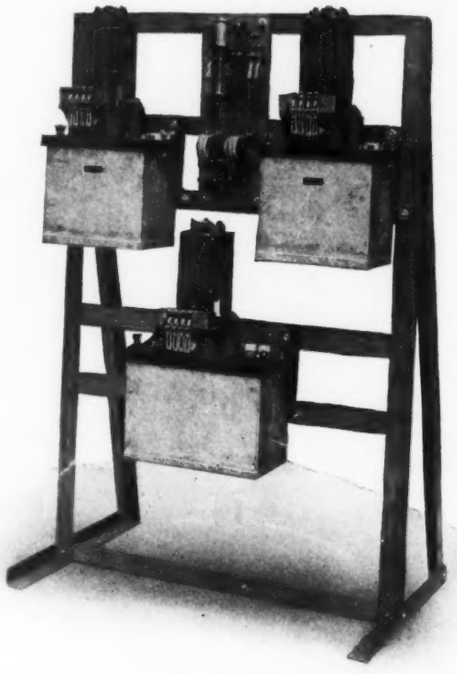
ELECTRIC RANGE

range. The broiler has a corrugated top, slanting slightly toward a grooved end, which receives the juices from the meat. There are no odors or gases from combustion absorbed in the meat, as in broiling with a flame. A separate smooth top fits on the broiler for making griddlecakes, toast, etc. The oven has double walls interlined with asbestos which confine the heat. It is heated from both top and bottom, and the desired temperature is distributed evenly throughout.

The utensils provided with each range have a "lock-on" device for perfect heating contact. They are made of heavy nickel-plated copper and include a blazer, a double boiler (porcelain food vessel), a vegetable boiler and a teakettle.

Automatic Starting Apparatus for High-Voltage Motors

Motors operating at high voltages are frequently desirable in large industrial plants, and for driving centrifugal pumps and similar machines 1100-volt and 2200-volt squirrel-cage motors are being used to a considerable extent. To make the starting of these motors easy and eliminate the danger of hand control the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has put on the market a new line of high-tension self-



AUTOMATIC STARTER FOR HIGH-VOLTAGE MOTORS

starters. These controllers, one of which is shown in the accompanying illustration, are of the multiple-solenoid type, and each consists of an angle-iron, floor-type, self-supporting frame, which carries the high-tension oil-immersed solenoid switches and the necessary relays for controlling the motor and auto-transformer circuits.

The oil-immersed primary and starting switches are operated by single-phase solenoids. All contacts are entirely immersed in oil so that no live parts carrying high voltages are exposed. Low-voltage energy is used for the operation of the solenoid coils. The ratings of the standard types of these self-starters range from 20 hp to 300 hp, and the devices are made for both twenty-five-cycle and sixty-cycle, three-phase circuits. They can be automatically controlled when operating on an open-tank system by means of a float switch, and on a closed or compression-tank system by means of a gage or diaphragm pressure regulator. For remote control from one or more points control stations can be employed so that the operator need only push a button to start or stop the motor.

Jobber, Dealer and Contractor

Looking Forward to a Good Year

Mr. W. W. Low, of Chicago, president of the Electric Appliance Company, is a shrewd observer of the trend of electrical business, and a man whose wide acquaintance and long and practical experience give weight to his opinion on the outlook in the electrical supply business. In the course of a recent conversation with a representative of the *Electrical World*, Mr. Low said that he thought that the year 1914 would be a good one for the electrical jobbing business. However, at the present time the purchasers of electrical supplies are buying only from hand to mouth. The volume of orders now being handled by the electrical jobbers is very large, but it is a noticeable fact that the average amount involved in each order is unusually small. Thus, while the jobbers, judging by Mr. Low's experience, are very busy—being rushed with business, in fact—the cost of doing the business is proportionately very high. However, Mr. Low is confident that normal conditions will be restored later in the year and that it may be expected that the size of individual orders placed by contractors, central stations and others will be increased as returning confidence supplants the somewhat unsettled conditions of the winter.

St. Louis Company Guarantees Work of Electrical Contractors

With the inauguration of its latest wiring contract for already-built houses, the Union Electric Light & Power Company of St. Louis, Mo., is guaranteeing the work of the electrical contractors who wire buildings for it. In the contract covering this work the price of the first item carries the entire overhead cost. Should the prospective customer contend that he does not wish all of the outlets in the first item, he is informed that the cost will be $17.95 whether all of the outlets are installed or not. The result is that all of the outlets are installed and the use of appliances is thus stimulated. The price schedule for wiring houses follows:

PRICE SCHEDULE FOR WIRING ALREADY-BUILT HOUSES*

One outlet in each of any two rooms on one floor, and in addition thereto one baseboard or wall outlet equipped with receptacle for electrical appliance attachment, ready for service connection	$17.95
One additional outlet on next floor	7.00
Each additional outlet on same floor with other outlets	2.00
Each switch outlet with flush wall switch (single pole)	3.00
Each two-circuit switch outlet with electrolier switch	4.50
Each switch outlet with flush wall switch (combination three-way)	4.00
Each additional baseboard or wall outlet with receptacle for electrical appliance attachment	3.75
One outlet in basement with switch on first floor (including flush switch)	5.00
One outlet in basement of second-floor apartment with switch on second floor (including flush switch)	10.00
Each additional basement outlet on same switch	1.00
Each drop cord with socket	1.00
Each pendent switch	1.00
Additional charge for wiring where there are double floors—per ceiling or floor outlet	2.00

*Does not cover outlets in brick walls or lamps.

Formerly the company in co-operating with the contractors in the city gave each a job in turn. Now the policy is to give each contractor in turn $100 worth of business regardless of whether it is made up of one or several jobs. In this way the company hopes to distribute the work more equitably among the various contractors. In case a contractor receiving work from the new-business department of the company has no credit or responsibility, the central station requires him to furnish a bond in order that it shall not suffer loss should his work on its contracts fail to give satisfaction. Mr. F. D. Beardslee, sales manager of the Union Electric Light & Power Company, states that the contractors are all well pleased with the schedule as well as with the other terms of the agreement.

Iowa Contractors Organize

The Iowa Electrical Contractors' Association was formed at a meeting held in Waterloo on Feb. 2. Mr. W. C. McCarten was elected president and Mr. M. T. Humphrey, of Waterloo, secretary. Twenty-six contractors became charter members. The next meeting will be held in Cedar Rapids on April 21.

Co-operation Between Contractors, Dealers and Central Station in Dayton

The Dayton (Ohio) Power & Light Company so thoroughly believes in co-operation between the electrical contractors, district representatives of manufacturers of electrical apparatus and the central station that it has arranged to hold dinners and meetings at least once every three months throughout the year, when all can get together, talk over the business that has been secured and plan for the future. The first of these dinners was held at the Phillips House in Dayton last month, and about thirty attended as guests of the Dayton Power & Light Company. Mr. Thomas F. Kelly, sales manager of the Dayton Power & Light Company, acted as chairman of the meeting which followed and told of the very successful year that the company had enjoyed in spite of the flood. He reported that the company had made an increase of 36 per cent in customers during 1913, which was an increase of 73 per cent over the 1912 increase. Predictions of a still greater increase for 1914 were made because of the arrangement that has just been completed with the electrical contractors whereby old homes can be equipped for electricity and payment made in monthly instalments. Many complimentary remarks were made by those present concerning the efforts put forth by the lighting company during the past year to further the interests of those engaged in the electrical industry in Dayton and vicinity.

Qualifications of the Electrical Contractor

Speaking for the electrical contractor at the dinner given by the Edison Electric Illuminating Company of Brooklyn on Feb. 7, Mr. Louis Kalischer, president of the Electrical Contractors' Association of Long Island, said that of the central station, the manufacturer, the supply house, the consulting engineer and the contractor, the latter is the only one brought into direct contact with each of the others as well as with the most important individual of all, the customer. Moreover, the contractor must possess a number of accomplishments. He is expected to know all forms of the lighting company's contracts and the service available in all parts of the city. He must be familiar with every device and appliance on the market (one large New York company manufactures over 57,000 devices alone) and must know where to get the material best suited for the work at the right price. He must also be familiar with all of the Underwriters' or the city department's require-

ments, and sometimes must divine the interpretations of the rules by individual inspectors. A good knowledge of building construction must be his. He must be able to size up workmen and at times know what the customer will need for future expansion.

In addition to the above, the electrical contractor must be equipped with a complete set of measuring instruments, in order to be able to make accurate tests on engines, generators, motors, etc., locate troubles and give advice. If he is awarded the contract, he must back his judgment with his own money as to the cost of labor and material to do the work, follow at times an ambiguous specification, and if possible complete the job to the entire satisfaction of all parties concerned. The electrical contractor is thus the shock absorber of the electrical business. From the time he spends his first money estimating on the job until he puts the final payment in the bank he has been hard at it.

Competition Between Dealer, Contractor and Central Station

BY C. L. EIDLITZ

Early methods of electrical merchandising were limited in effectiveness because the stock then handled consisted of only standard supplies and fittings which could not be made features of new-business campaigns. Now, when every opportunity is afforded to make the electric-supply store and show windows attractive with displays of household devices, ornamental fixtures, etc., the dealers are handicapped by the central-station companies selling supplies at prices which permit of no competition. It was logical for the electric-service companies to sell supplies at wholesale and even give them away when electricity was first being introduced and a struggle was being made to supplant gas. But now, in fairness to the contractors and dealers whose legitimate business it is to sell supplies, it seems that central-station companies should limit their field of business to supplying energy only.

When the electrical business was first being built up central-station companies maintained large business-promoting staffs and paid attractive commissions in addition to salaries to members of the staff for every energy contract secured. Houses were even wired for nothing to induce people to use electric service. A considerable portion of the burden of securing new business was taken off the central stations when electrical contractors sprang into existence, as the latter were necessarily compelled to connect the buildings which they wired onto the electric-service company's distributing system. For this service the contractor received no recompense from the central-station company, even though it was enabled to reduce its business promotion expenses thereby.

The Contractor Shut Out from Legitimate Business

Instead of the contractor being allowed to furnish all of the apparatus and supplies which might be required in buildings wired by him, as time passed on the central stations and wholesale supply dealers quoted such low prices on supplies that the contractor became unable to make a profit on what is his legitimate business. If this condition did not exist, a contractor might have a lifelong customer in the person whose building was wired and build up an electrical supply business which would bring him a nice profit without inflicting a hardship on anyone.

Since the price of tungsten lamps is decreasing and their life increasing, lamp renewals are no longer a factor in securing or holding central-station business, so that electric-service companies might as well stop the practice and allow dealers and contractors to profit by the sale of lamps. By doing this the electric-service companies would be able to eliminate the lamp-renewal department, cutting down overhead charges, labor expense, etc., and devoting such savings to a reduction in rates.

If there were a profit in selling electrical devices and supplies (and there isn't in cities where they are sold at wholesale or below cost), contractors and dealers would have an incentive to do campaigning, and electrical apparatus would be given as widespread distribution by them as central stations are now giving it. There should be co-operation between the central stations and dealers, the former introducing new apparatus and informing the public where their nearest supply dealer is stationed, and the latter supplying the goods.

A Trade Divided Against Itself

Electrical merchandising can be extended to include the selling of a contractor's services. As the Underwriters' stamp must be on all wire and conduit installed in buildings, there is little difference in the quality of material which a good and an inferior contractor can furnish. The superiority of one contractor over another consists in the method of installing the apparatus. Every contractor should be compelled to qualify himself before inspection is allowed on his work. The work done by contractors could be relied on more than it is at present if "pawnbroking" of electrical contracts by the petty contractors could be prevented.

Cases have arisen where competent contractors have been deliberately underbid by some inferior contractor who knew that the work could not be accomplished according to specifications at the sum quoted by him. Being the lowest bidder, however, he generally secures the contract and then assigns it to a supply house, with the agreement that the latter shall pay him in instalments for supervising the work. Not always being acquainted with the job or the fact that the contractor has underestimated the cost of doing the work, the supply house and the party letting the contract are made the "goats" of the deal. The low-bidding contractor starts the work in apparent good faith and after receiving several payments which are in excess of the value of the work done he finally declares that more than the sum contracted for must be paid before the work can be finished. If the contractor fails to receive the additional amount, he usually disappears, leaving the supply house to face the task of completing the job at a loss.

Contractors would also have a better basis on which to make estimates on work if a more strenuous attempt were made to prevent the sale of stolen goods to contractors. If all contractors were to buy direct from the supply houses and ignore the ridiculously low offers made by some transient salesmen on electrical supplies, the "fences" could soon be put out of existence. As things exist now, some contractors are able to make extremely low bids on electrical work as they make a practice of buying from these "fences." Supply houses could also avoid considerable losses if a detective was sent to watch goods when they are delivered if there is doubt as to the identity of the party receiving them. Often when a mysterious order is received by telephone the supply house will refuse to deliver the goods. Many of the "fences" would be discouraged and frightened out of continuing their illegitimate practice, however, if the goods were delivered and a detective hired to follow the goods and learn how they are disposed of. These illegitimate methods of conducting a business are responsible for a great share of the unsuccessful attempts to conduct business on a legitimate basis.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Mercury Mine in Nevada to Be Electrically Operated.—The Westinghouse Electric & Manufacturing Company reports the receipt of an order from the Nevada Cinnabar Company, Ione, Nev., for electrical equipment consisting of a 50-kva generator and motors for operating pumps, crusher, elevator and fans. This is the first electrically driven mercury mine in Nevada.

President Herr of the Westinghouse Company Optimistic.—Reports from Pittsburgh credit E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, with the expression, in a recent interview, of some very optimistic sentiments anent the present industrial condition of the country. He thinks that the business depression which started last fall is fast vanishing and that everything indicates a slow but steady and permanent improvement. This seems to be a very general opinion among the leading men in the electrical as well as other industries.

Electric Drive in a Kentucky Tannery.—After using steam power exclusively for over half a century in some cases, the leather-working concerns of Louisville, Ky., are giving careful attention to the question of electric drive at the present time. William Schuff & Company, tanners, have just completed the erection of a four-story reinforced-concrete building to be used for their cutting operations. The company employs steam power in its tannery proper, but, instead of providing for similar operation in the new plant, arrangements have been made to drive the cutting machines with electricity, General Electric motors being installed. Central-station energy is supplied by the Louisville Gas & Electric Company, which is taking up actively the extension of its service among the industries within its territory.

American Engineers Secured for Large Canadian Development.—Announcement has just been made by Sir William Mackenzie of plans for the development of a large hydroelectric power site on property of the Winnipeg (Manitoba) Electric Railway near that city. Plans for an immediate installation to deliver 40,000 hp are to be drawn up, and the ultimate capacity of the site is estimated at over 100,000 hp. The energy will be used for traction, lighting and industrial drive. In 1904 the Winnipeg Electric Railway was incorporated as a consolidation of the Winnipeg Electric Street Railway and the Winnipeg General Power Company, and it now controls the Winnipeg, Selkirk & Lake Winnipeg Railway and the Suburban Rapid Transit Company. Its present generating capacity is 50,000 hp, of which 30,000 hp is generated at the hydroelectric plant at Pinawa Channel, Winnipeg River. The authorized capital stock of the company is $10,000,000, of which $9,000,000 is outstanding. The exploration, surveys, designs, plans and estimates for the new plant will be made by the J. G. White Engineering Corporation, of 43 Exchange Place, New York City.

South American Customs Concerning Foreign Business Representatives.—In view of the rapidly increased interest being shown by American business enterprises in the possibilities for foreign trade with the countries in South America, it may be of some benefit to outline the results of a recent government investigation into the customs and policies of these countries, with regard to the activities of foreign business representatives within their several boundaries. In most of these countries there is a tax levied on all business enterprises, and in order to put the importer on the same competitive basis his commercial representative is also taxed. Ordinarily the tax may be annulled if the agent associates himself with some local firm, through which goods will be booked and delivered. Usually samples are admitted free of duty for a temporary period, but the practice varies. In some places a deposit equal to the duty charge must be made on entry and is refunded on re-exportation, and in other places a bond executed with satisfactory securities is sufficient. Samples of no intrinsic value are admitted duty free in practically every country. In many cases it is advisable that the traveling representative hold power of attorney from his firm. The first thing that a commercial agent should do, in nearly every case, is to get in touch with the American consul as soon as possible after his arrival in any South American country.

Present Rate of Business of the General Electric Company.—Sales of the General Electric Company for the first few weeks of the present year have been at the rate of about $80,000,000 per annum, or approximately 75 per cent of the average rate for 1913. This represents a larger decline from the figures for the corresponding period of last year. At the present time the mainstay of the company is its business in small apparatus and supplies. The present working force is more likely to be decreased than increased, and a high official stated that the first six months of 1914 will show less than normal activity. The final report for the past year has not yet appeared, but the closest estimates, checked by the opinions of the executives of the company, place last year's business at $105,000,000 sales billed out and $111,000,000 orders booked. It is expected that the 1913 earnings on the $101,369,600 outstanding stock will amount to about 16 per cent, the same percentage earned during 1912 on a capitalization of $77,764,700. For a long period the company's sales have been growing at a rate which has made necessary steady additions to its plant capacity. Expenditures for this purpose during the last two years have been between $8,000,000 and $10,000,000, and it is considered unlikely that this program of expansion of production facilities can be materially curtailed without seriously affecting the ability of the company to handle the business anticipated for 1915. The copper consumption of the General Electric Company during 1913 was in the neighborhood of 75,000,000 lb., representing an increase of about 10,000,000 lb. over the figures for 1912.

An Efficient Method for Supervising Production.—In a large industrial plant recently visited by an *Electrical World* representative several features of particular merit were observed in connection with the system used for pushing production. This company manufactures large power station apparatus, of a kind which calls for special designs on a big percentage of its output, and the stock parts are only the small pieces which can be standard in a wide variety of product. The production order system used is similar to that in use by the better class of factory generally, and is made to include everything down to the smallest stock parts. The point of special merit in this plant, however—and one which is believed to be distinctive—is that as soon as the order for a piece of apparatus has passed the business or order department it goes to the shipping department, on which is placed the full responsibility for its proper progress through the shops and its completion on the contract shipping date. The shipping department is the one which naturally bears the burden of criticism in case of delay, and this placing of responsibility with it for the whole production operation is the best possible arrangement. The fruits of the system are proved best by a trip through the shops. There is a regular path along which the product travels from raw material to finished apparatus. Except in cases of very special work, the material enters regularly at a given point, passes in regular order from tool to tool and leaves each shop at a regular point. Inspection of the product in its several stages is made very easy under this system. The product travels along the shortest possible path and receives the minimum of handling possible, and it is possible to tell exactly where a given job stands at all

times. The above system also lends itself most easily to intensive cost keeping, and that part of the operation of the plant in question has been worked out to a very fine point. The kernel of this whole system is the placing of responsibility for the entire production operation in one place, and in the right place, with the department which performs the final act of shipping the product to the purchaser.

An American Engineer's Views on European Conditions in the Electrical Industry.—In an interview with an *Electrical World* representative, Theodore Stave, of 30 Church Street, New York City, who recently returned from an eight months' trip to England and the Continent, spent in an investigation of the latest electrical developments abroad, stated that he had observed as great industrial activity in Europe as in the United States, and that both foreign and domestic practices in electrical matters seem to be progressing toward common standards. The "safety first" movement, he thinks, is the biggest one in both continents at the present time. He stated that there is a field abroad for some classes of American electrical goods, particularly those where the competition is on design or quality rather than on price, as in the latter consideration the article of home manufacture has a decided advantage. In the opinion of Mr. Stave, the interest shown abroad—especially in Germany—in the question of improved illumination, both interior and exterior, is as great as or possibly greater than that shown in this country. He said that the nitrogen-filled tungsten lamp has been eagerly taken up there, and that these lamps are rapidly coming into common use in the streets of Berlin. Their use in interior illumination work of the indirect or semi-indirect class seems to be advocated there also to some extent. Touching on some of the projects of electrical interest abroad at this time, Mr. Stave stated that plans are on foot for the electrification of the elevated and surface railroad lines in Berlin, a move which will call for the expenditure of about 60,000,000 marks and will be participated in by both the city and state. Another big move which is pending is the building of a generating station of unusual size in the coal district near Berlin, from which that city will draw a large part of its electrical energy supply. The negotiations for this project are now going on. According to Mr. Stave, some of the finest hydroelectric development work in the world has been done in the district around Milan, Italy. Generating stations of large capacity have been constructed there and are supplying a big part of the power for the silk mills in the district and for electric traction purposes. He said that high-tension alternating-current railway operation has reached an advanced stage of development in Italy, Switzerland and Germany, and he spoke of the recently completed Loetschberg line as one of the finest pieces of electrical engineering in existence. While abroad Mr. Stave was on the look-out for new ideas and devices that would prove adaptable in this country, and he is now preparing to introduce some special electrical apparatus new to the American trade.

Industrial Opportunities in the Pacific Northwest.—The following extract from a recent statement by W. E. Herring, industrial agent of the Puget Sound Traction, Light & Power Company, contains much of interest to the electrical industry. He said in part: "That the opening of the Panama Canal will mean a great influx of Europeans to the entire Pacific Coast, and particularly to the Pacific Northwest, is now conceded by every person who has given the matter any thought. This will result in more completely fulfilling one of the conditions which is essential to industrial preeminence and will be one large factor in promoting the industrial growth of this region. Accompanying the influx of labor will be the usual large increase in the population, drawn, for the most part, from other portions of the United States. Such a condition naturally means a much larger market for all products, and coupled with the existing demand must necessarily mean that many of the articles manufactured in the East and Middle West and shipped here by rail will be more economically manufactured on the ground. With an enormous supply of the raw materials needed in many of the industries, with a market extending over the entire Pacific Coast States—having a population at present of more than 4,500,000—and with the Orient and Hawaii as an additional market, there can be no question that the number of manufacturing concerns will rapidly increase. The four essentials for industrial success are a market for the product, the raw materials needed in its manufacture, labor and transportation, and, to a smaller extent, cheap power may be added. In addition to possessing the other requisites, the Pacific Northwest has the advantage over other parts of the country in having cheap power. This is occasioned by the fact that the streams on the west side of the Cascade Mountains have a rapid fall in their short length; the precipitation is heavy, and a natural storage reservoir is afforded in the enormous snow fields and glaciers. This means that the streams can be harnessed and electrical energy delivered at low cost. The developments so far made on the various streams are but a small portion of the potential energy in them. Much has been said of the enormous power resources of the Pacific Northwest, but little thught has been given to the use that could be made of the power when developed. Heretofore the market was the secondary consideration, for the simple reason that there was a continual demand for additional power. Since the present markets, however, have been saturated, it is necessary that the additional uses for power be found before any new developments will be made. There is at present in the Puget Sound region available for immediate delivery by the Puget Sound Traction, Light & Power Company approximately 40,000 hp out of its total of 140,000 hp. Before this amount of power is absorbed additional steps will be taken to increase the capacities of some of the present operating plants or to construct new plants to meet the demand. The Puget Sound region of the Pacific Northwest is at present supplied with electrical energy for both light and power purposes by the above-mentioned company from four hydraulic plants and six steam plants, with a total one-hour actual operating capacity in the water-power plants of 98,000 hp and a total capacity in the steam plants of 41,233 hp, making a total of 139,233 hp. The territory served by these plants extends from Tacoma on the south to the British Columbia line on the north. The rate for residence lighting in the city of Seattle is 6 cents per kw-hr. for the first 60 kw-hr. and 4 cents for all over that amount, with a monthly minimum of 50 cents. The rates for motor service are as low as can be had anywhere in the United States, with the possible exception of the Niagara Falls district. The rate given depends upon the amount of power used, the manner in which it is used and the particular location of the plant in question. These rates vary from a little less than $20 per hp a year, to large users of continuous power, upward. The Puget Sound Traction, Light & Power Company has established an industrial department for the sole purpose of getting in touch with Eastern manufacturers, calling their attention to the possibilities existing here, furnishing any and all kinds of information in regard to markets, transportation, labor, raw materials, power and any other essentials needed in their particular line, with the idea of eventually attracting these manufacturers to this part of the country."

NEW YORK METAL MARKET PRICES

	Feb. 9		Feb. 17	
Copper:	Bid	Asked	Bid	Asked
Standard spot*	.....	14.75	14.12½	14.50
	Selling Prices		Selling Prices	
	£ s. d.		£ s. d.	
London, standard, spot*	65 0 0		65 2 6	
Prime Lake	14.87½ to 15.12½		14.87½ to 15.12½	
Electrolytic	14.65 to 14.75		14.60 to 14.70	
Casting	14.45 to 14.55		14.40 to 14.50	
Copper wire base	15.87½ to 16.00		15.75 to 16.00	
Lead	4.15		4.00	
Nickel	40.00 to 45.00		40.00 to 45.00	
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.45 to 5.47½		5.40 to 5.45	
Tin, spot	40.12½ to 40.50		39.65 to 39.85	
Aluminum:				
Prompt delivery	18.75 to 19.00		18.75 to 19.00	
Future	18.50 to 18.75		18.50 to 18.75	

*OLD METALS

Heavy copper and wire	13.75	13.75
Brass, heavy	8.87½	8.87½
Brass, light	7.87½	7.87½
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Feb. 17 21,434

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Initial Dividend Declared on Central States Electric Common Stock.—The directors of the Central States Electric Corporation recently declared an initial quarterly dividend of 1 per cent on the $5,451,900 common stock of the company, putting it on a 4 per cent per annum basis. This company controls the Cleveland Electric Illuminating Company through ownership of about 75 per cent of the common stock of the latter.

Suit to Prevent Unified Operation of Surface Street-Railway Lines in Chicago.—Attorneys representing Clarence H. Venner, of New York, have brought suit in the United States District Court in Chicago against the city of Chicago, the Chicago City Railway Company, the Chicago Railways Company and others, seeking to prevent the carrying out of the ordinance providing for the unified operation of the surface traction lines of Chicago. It is asserted in the bill filed for Mr. Venner that he is the holder of $40,000 worth of stock in the Chicago City Railway Company and that his rights as a stockholder will be placed in danger if the unified-operation plan is carried out.

Oragnization Change in the Electric Properties Corporation.—Announcement has been made of the resignation of A. L. Kramer from the vice-presidency of the Equitable Trust Company, in order to accept the presidency of the Electric Properties Corporation of New York, succeeding J. F. Wallace, who has resigned that position in order to devote more time to the affairs of Westinghouse, Church, Kerr & Company, of which he is president. The entire stock of the latter concern is owned by the Electric Properties Corporation, which was organized in 1906 for the purpose of managing and financing public utility properties, and bears much the same relation to the Westinghouse interests that the Electric Bond & Share and the Electrical Securities companies bear to the General Electric interests. Among the directors of the Electric Properties Company are A. W. Krech, G. E. Tripp, George Westinghouse, J. F. Wallace, F. Q. Brown, P. D. Cravath, and H. R. Hayes.

Atlantic Gas & Electric Company Prospering.—The report presented by President A. D. Lord to the security holders of the Atlantic Gas & Electric Company on Feb. 14, covering the last quarter of the year ended Dec. 31, 1913, contains information of general interest. During this period a 2000-kw General Electric turbo-generator was installed at the plant of the Binghamton (N. Y.) Light, Heat & Power Company, doubling the rating of that station and increasing its operating efficiency. Within the present year another unit of equal size is expected to be installed in this plant. The Dock Street station at Easton, Pa., is being completely overhauled and two 5000-kw generating units are being installed, together with the necessary auxiliary equipment. At Boonton, N. J., the present plant is being overhauled and a new station is in process of construction. The gross earnings of the company for the fiscal year 1913 were $1,126,254, and, with the completion of the above construction program, it is expected that even greater attention can be given to the expanding of the company's service, producing a corresponding increase in gross and net earnings.

Pennsylvania Utility Declares First Dividend on Common.—An initial quarterly dividend of 1 per cent has been declared on the outstanding common stock of the Pennsylvania Water & Power Company, payable Apr. 1. According to the report of J. E. Aldred, president of the company, covering the fiscal year ended Dec. 31, the gross income for that period was $826,815 and the net earnings amounted to $709,767. For the same period a surplus of $302,663 was realized. In the Nov. 1, 1913, issue of the *Electrical World* note was made of the installation by this company, at its Holtwood (Pa.) plant, of a 16,000-hp generating unit, and the same item gave an idea of the recent growth of the concern. It is now understood that another generating unit of the same size as the above mentioned is to be installed shortly. At the Baltimore (Md.) substation a seventh transformer of 10,000-kw rating will also be installed in the near future. A duplicate transmission line is to be built to handle the large and growing Baltimore load and it is estimated that the saving in resistance losses will be sufficiently large to finance the new construction, costing in the neighborhood of $400,000.

Insull Emphasizes Value of Selling Efficiency.—Speaking recently on the question of the factors affecting the values of public securities, Samuel Insull, president of the Commonwealth Edison Company of Chicago, and one of the leading operating men of the day, expressed the opinion that the factor of primary importance in the growth of an operating electrical property is the efficiency of its selling force. This, he said, has more real bearing on the prosperity of the enterprise than the replacement value of either the generating or the distribution system. As between first-class construction work on a station and first-class sales engineering in pushing its business, he said that the latter is by far the more desirable and the harder to obtain. This statement, by a man of such signal attainments in the field in question, should carry great weight, and at a time when the public utility security seems to be in particular favor with the investing public it comes with special emphasis as an aid to the wise selection of the strongest securities.

Employees Benefit Under Columbus Merger.—Following the completion of the public utility merger in Columbus, Ohio, the announcement has been made of an increase in the wage scale of the Columbus Railway, Power & Light Company, a change which affects 700 employees and will increase the pay roll $32,000 per year. The company also placed in effect a pension and death benefit plan by which members will pay an entrance fee of $1 and dues of 50 cents a month, the company to add to this 50 per cent of amounts paid by the men each month and also to pay all expenses of operation of the pension system. Sick benefits of $1 a day will be paid and $150 funeral expenses. Without assistance from the beneficial association the company also agrees to pay a death benefit of $500 to actual dependents of an employee who has been with the company more than two years and has been receiving less than $200 a month salary. After service of twenty-five years an employee may retire at the age of sixty-five years and receive a pension of $30 a month.

Financing of Telephone Expansion.—The annual report of President B. E. Sunny of the Chicago Telephone Company for the year 1913 shows that the total number of telephones connected to the company's exchanges at the close of the year was 430,812. Six years ago the number of telephones connected was less than half of the present number. The increase in the number of telephones in Chicago continues to be largely for the low-priced service. In 1913 the number of telephone stations increased 48,275. About $6,000,000 of new capital will be required in 1914 to care for new subscribers. The rapid growth not only means the addition of new plant but also involves the replacement of existing plant, in some instances long before it has had a normal life. Mr. Sunny makes some interesting observations on this point, substantially as follows: "While the replacement has been in the past largely with reference to outside plant, the removal of poles and wires and the substitution of aerial or underground cables, and the substitution of larger cables for smaller ones, we are in a condition now where several exchanges in the city, including the land, buildings, switchboards and other equipment, must be abandoned. The salvage value of these exchanges will be small, but new and larger exchanges must be provided. Not only are exchanges outgrown, but the wire center shifts. Exchanges located ten years ago, or even more recently, at what were then the wire centers of the districts to be served, are now found to be from half a mile to a mile or more from the present or prospective centers, owing to new telephones installed. Because of the heavy expense for conduits and cables, the necessity of having exchanges centrally situated will be readily appreciated. The exchanges of recent years have been constructed with reference to a continuing large growth. Larger parcels of ground have been bought and buildings and switchboards provided in such manner that additions can be made readily and effectively." The 430,000 telephones of the company are used on an average seven times a day for outgoing calls. The gross earnings for 1913 were $16,274,602, compared with $14,538,399 in 1912. Other figures from the earnings statement for 1913 are as follows: Operation expenses, $6,620,-413; current maintenance, $2,581,391; depreciation, $2,608,-530; taxes, $858,300. Deducting the sum of these items leaves $3,605,968 as the net earnings for the year. From this was paid bond interest and 8 per cent dividends on $27,000,000 of capital stock.

Business Notes

Horace M. McCord & Company, with headquarters at 433 Lumber Exchange, Minneapolis, Minn., have taken over the business of manufacturing electrical specialties formerly conducted by H. M. McCord.

The Falkenbach Manufacturing Company, manufacturer of wood-fiber composition lighting fixtures, has moved its headquarters from 103 Park Avenue to 159 East Fifty-fourth Street, New York City.

Fairbanks, Morse & Company have recently made organization changes by which A. C. Browne, who has been in charge of the electrical department of the New York office during the past year, has been transferred to a similar position in the Baltimore branch office.

Meikleham & Dinsmore, bankers, 25 Broad Street, New York, have just opened a Pittsburgh office, under the direction of F. S. Carmack, with whom are associated A. S. Everest, H. L. McVicker, W. R. Crawford and David Stewart. N. P. Hall was recently appointed representative of the firm in western New York, with offices at 72 Pearl Street, Buffalo, N. Y.

The Oshkosh Manufacturing Company, of Oshkosh, Wis., has appointed the Union Electric Company, of Pittsburgh, Pa., as its Pittsburgh agent and has arranged for that company to carry a large and representative stock of its construction tools and specialties, ready for prompt shipments. Arrangements have been made so that the Eastern jobbers can use this stock to advantage.

Horace F. Bowser, lighting specialist, of 489 Fifth Avenue, New York City, has announced the addition of a "residence lighting" department to supplement the commercial lighting business established by him in the latter part of October, 1913. Mr. Bowser aims to act directly between the manufacturer and the purchaser on all apparatus and fixtures necessary for lighting installations and, by combining art with engineering, to secure the best results possible in lighting effects and fixtures.

New Industrial Companies

The Autophone Company of New England, of Boston, Mass., has been incorporated with a capital stock of $600,000 by E. B. Lyman and C. H. Knapp, of Brookline, Mass.

The Mercer Gas & Electric Fixture Company, of Trenton, N. J., has been chartered with a capital stock of $25,000 to manufacture gas and electric fixtures. The incorporators are R. H. Rue, H. O. Bruner and C. L. Snedeker, of Trenton.

The Ellington Electric Company, of Quincy, Ill., has been granted a capital stock of $1500 to manufacture and deal in electrical apparatus, appliances, etc. The incorporators are Lawrence M. Persons, W. Collins Morris and J. R. Williams.

The Salom Electric Storage Battery Corporation has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $830,000 and proposes to manufacture batteries, electrical appliances, etc. The incorporators are H. E. Latter, W. J. Maloney and O. J. Richard, of Wilmington.

The Lighthouse Electric Company, of Toledo, Ohio, has been incorporated with a capital stock of $10,000 to handle electrical supplies. The company proposes to operate a chain of ten stores in Ohio, including one at 243 Michigan Street, Toledo; one each in Dayton, Columbus and Lima, and two each in Cleveland and Cincinnati. The incorporators are Samuel L. Allen, Frank H. Farnsworth, George M. Frink, Stephen M. Hegel and George F. Beatty.

The American Electric Car Company, of Saginaw, Mich., has been organized with a capital stock of $1,250,000. The company is a consolidation of the Argo Electric Company, of Saginaw, the Broc Electric Company, of Cleveland, Ohio, and the Borland-Grannis Company, of Chicago, Ill. The headquarters and plants of the company will be in Saginaw. C. W. Brand, president of the Broc Electric Company, is president, and Theodore Huss, of Saginaw, is secretary and treasurer.

Trade Publications

Insulators.—Drawn-steel-pipe insulators are described and illustrated in a leaflet published by the Wirt Company, Philadelphia, Pa.

Generating Sets.—The generating sets made by Engberg's Electric & Mechanical Works, St. Joseph, Mich., are illustrated on blotters being distributed by the company.

Switches.—Bulletin 800 of the Pacific Electric Manufacturing Company, San Francisco, Cal., briefly describes and shows diagrammatically the company's weatherproof oil switch.

Motors and Motor Appliances.—Bulletin No. 15-A of the Menominee Electric Manufacturing Company, Menominee, Mich., contains the net prices to the trade on its power motors and motor appliances.

Electric Stoves.—A folder recently issued by the Hotpoint Electric Heating Company, Ontario, Cal., refers to its electric range "El Bako" and its disk stove "El Stovo," briefly setting forth their advantages.

Resistance Boxes.—Bulletin No. 476 of the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., refers to its unit-type Wheatstone bridges and resistance boxes, which are described and illustrated.

Second-Hand Machinery.—The Glow Electric Company, 219 Walnut Street, Cincinnati, Ohio, has issued its Pocket Bargain Sheet No. 11, which contains a long list of "Glow rebuilt" electrical machinery for sale, indexed for easy reference.

Post Grinder.—The Stow Manufacturing Company, Binghamton, N. Y., has issued an illustrated leaflet relating to its tool-post grinder for 110 or 220 volts, sixty cycles, alternating or direct current, and another leaflet referring to its electric bench grinder.

Governors.—"Lombardata I"—a card 5⅜ in. by 7¼ in.—shows an effective illustration of the Mississippi Power Company's plant at Keokuk, one of the "famous plants Lombard-governed." This card is the first of a series being prepared by the Lombard Governor Company, Ashland, Mass.

Terminals.—A catalog recently issued by the Meliorite Manufacturing Company, 290 Taaffe Place, Brooklyn, N. Y., refers to its terminals. These are said to protect the insulation, reduce the ill effects of strains and make perfect contact with the wire at two points without the use of solder.

Lamp Holder.—In an eight-page leaflet issued by the Adjustable Light Holder Manufacturing Company, 416 Penn Avenue, Pittsburgh, Pa., an illustrated description is given of its adjustable lamp holder. With the use of this device a lamp can be easily adjusted to any height or angle from the ceiling to the floor.

Lamps.—The Wallace Novelty Company, 299 Madison Avenue, New York, has issued a folder illustrating and briefly referring to the flexibility of the Wallace electric lamp. This lamp can be hung or stood in any place desired, making it adaptable for all lighting needs in the office and home or when traveling.

Headlamp Device.—An electrically controlled device that enables the driver of an automobile to see the roadway perfectly at night, with the glare from the headlamp eliminated, is the subject of a leaflet issued by the Ward Leonard Electric Company. "Nodaz" installed on a headlamp enables the lamp to be operated at full candle-power in any city street.

Aluminum.—The British Aluminum Company, Ltd., 109 Queen Victoria Street, London, E. C., England, devotes Leaflet No. 130a to an illustration of and brief reference concerning aluminum in the automobile chassis; No. 221a to aluminum netting and gauze; No. 129a to aluminum mandrels for rubber manufacturers, and No. 145 to aluminum insulation for magnet coils.

Ventilating Sets.—The Sturtevant "ready-to-run" ventilating set is the subject of an attractive and readable booklet of twenty-eight pages which tells the story of this apparatus in a concise manner and one readily understood by the layman. Well-selected illustrations embellish the text. These ventilating outfits are made by the B. F. Sturtevant Company, Hyde Park, Mass.

Personal Mention

Mr. Frank J. Duffy, manager of the Southern Railway & Light Company, Natchez, Miss., has been elected chairman of the depositors' committee of the First Natchez Bank.

Mr. B. F. Tucker, formerly superintendent of District T at Taylorville, Ill., for the Central Illinois Public Service Company, has been placed in charge of Districts T and W.

Mr. W. H. Booth, president of the Hot Point Electric Heating Company, Ontario, Cal., sailed for South America on Feb. 7, with his family and a party of friends, for a two months' trip.

Mr. W. M. Stowell, formerly superintendent of District W for the Central Illinois Public Service Company, has been transferred to the company's engineering department at Mattoon, Ill.

Mr. J. B. Crawford, formerly superintendent of District M for the Central Illinois Public Service Company, with headquarters at Mattoon, Ill., has been placed in charge of Districts M and D.

Mr. B. E. Sunny, president of the Chicago Telephone Company and of other Bell telephone companies, has been elected a member of the Chicago City & Connecting Railways collateral trust.

Mr. C. F. Ziegler, president of the Reynolds Electric Flasher Manufacturing Company, Chicago, is making an extended trip through the South and will include Cuba and Panama in his itinerary.

Mr. A. Ludlow Kramer has been elected president of the Electric Properties Company, New York, succeeding Mr. John F. Wallace, resigned. Mr. Kramer was formerly president of the Equitable Trust Company.

Mr. P. T. Glidden, manager of the Consumers' Power Company, of St. Paul, Minn., has been elected president of the Minnesota Electrical Association to succeed Mr. Eugene Holcomb, resigned, owing to removal from the State.

Mr. Mike S. Hart, of Chicago, commercial agent of the Middle West Utilities Company, has been appointed secretary of the rate research committee of the National Electric Light Association, succeeding Mr. William J. Norton.

Mr. William J. Norton has resigned as secretary of the rate research committee of the National Electric Light Association. Mr. Norton still remains a member of the committee and editor of *Rate Research*, the committee's weekly paper.

Mr. Hugo Reisinger, New York City, has accepted the invitation of the Earl of Kintore to become honorary commissioner and chairman of the American fine arts committee for the Anglo-American Exposition to be held in London this summer.

Mr. Edward Schwartz, until recently vice-president for William E. Slaughter & Company, Chicago, and designer of the Schwartz line of electric-heating specialties, has severed his connection with that firm. Mr. Schwartz, who is a native of Austria and who was in earlier life an expert tool maker, has been connected with the Western Electric Company and the Pelouze Manufacturing Company.

Mr. H. S. Whiting has been employed by the Isthmian Canal Commission as illuminating engineer. He will have charge of the designs for all interior and exterior artificial lighting for the permanent buildings of the commission in the Canal Zone, as well as public lighting arrangements at the permanent town sites. Mr. Whiting is a member of the Illuminating Engineering Society and was formerly connected with the Holophane Company.

Mr. George D. Baxter, who was superintendent of the Haverhill (Mass.) Electric Company for thirteen years and is now manager of the Exeter (N. H.) plant of the Tenney Service Association, was the guest of honor at a banquet of the Haverhill Electric Club held in that city on Feb. 3. During the course of the dinner Mr. Baxter was presented with a gold open-face watch engraved with his initials on the outside and inscribed "George D. Baxter, from Employees of the Haverhill Electric Company, 1914," on the inside of the case.

Mr. Harry C. Slemin, sales and advertising manager for the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., has resigned to become advertising manager for the Yawman & Erbe Manufacturing Company, of Rochester, N. Y. Mr. Slemin started in the telephone business in Chicago for the Western Electric Company in 1896. In 1904 he joined the new Stromberg-Carlson organization, which was moved to Rochester, N. Y., where he took charge of the apparatus engineering department. Following the engineering work he was given charge of the lead-covered cable business and foreign sales work and in 1910 was made sales and advertising manager.

Obituary

William Henry Boardman, for many years editor of the *Railroad Gazette*, now the *Railway Age Gazette*, died in Ridgfield, Conn., on Feb. 16. He was born Aug. 3, 1846, in Dixon, Ill. He received the degrees of A.B. and C.E. from the University of Michigan in 1868 and 1869. With the exception of one year, his whole active life was spent in the service of the journal mentioned, which by reason of his guidance reached and maintained the highest of editorial standards in engineering publications.

Francis H. Soden, one of the pioneer electrical men of Chicago and an employee of Edison in the early days of electric-lighting invention at Menlo Park, died at his home in Chicago on Feb. 14. Mr. Soden was born in Newark, N. J., fifty-five years ago and in his young manhood, following his work with Mr. Edison, he was one of those engaged in the electrical work on the old Pearl Street station in New York City. About 1881 young Soden was sent West for the Edison electric lighting interests. He installed the first electric-lighting plant in Minnesota, at Stillwater, and was also electrical constructor for the famous Appleton (Wis.) plant, the first electric central station in the world. Soon after this he went to Chicago, where he lived for the rest of his life.

FRANCIS H. SODEN

He was associated with the late George H. Bliss, and also with the Western Edison Electric Light Company, and for about five years was engaged in the installation of isolated electric-lighting plants in Chicago. Mr. Soden installed the first electric-lighting equipment in a Chicago theater at the old Academy of Music. About 1887 he accepted a position with the Chicago office of the Thomson-Houston Electric Company, where he was engineer of the lighting department. In 1891 Mr. Soden was one of five electrical men recommended by the Chicago Electric Club of that day for appointment as electrical adviser to Mr. D. H. Burnham, chief of construction for the World's Columbian Exposition. For a time Mr. Soden was engaged in business for himself as an engineer and contractor. He possessed much inventive ability and perfected a number of switching and other electrical devices. He is credited with inventing the flexible electric heating pad for his own use while ill with pleurisy. He also developed apparatus for electrically melting ice in frozen water and gas pipes. He was handicapped for long periods by sickness, but with it all he maintained an indomitable spirit and a constant cheerfulness that endeared him to his friends. For a time he was associated with John R. Markle in street-railway enterprises. Of late he had been employed by the Middle West Utilities Company in charge of the electrical exhibition car "Electra," described in the *Electrical World* of July 26, 1913. He returned from a trip last December, and while the car was laid up for the winter he joined the forces of the Electric Shop of Chicago during the holiday rush. Although Mr. Soden had been in failing health for the last six weeks, his death was quite sudden. Heart failure caused by kidney trouble was given as the cause. Mr. Soden is survived by a wife, three daughters and a brother, John K. Soden, of the city electrical department of Portland, Ore.

Construction

New England

WILTON, N. H.—The Public Service Commission has granted Robert Ware permission to furnish electricity from his plant at West Wilton to any point within a half mile of the band stand.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, D. C., until March 14, for furnishing and installing elevator machinery, including alterations and repairs to freight elevator in Building 34, Navy Yard, Boston, Mass., to cost about $1,300. Specifications may be obtained on application to the bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

BROCKTON, MASS.—The city of Brockton has presented a petition to the State Legislature asking permission to establish a municipal electric-light plant.

HOLYOKE, MASS.—Extensive improvements and extensions are contemplated by the Holyoke Street Ry. Co., which will involve an expenditure of about $100,000 and increase the output of the plant to 5000 hp. The plans provide for the installation of additional boiler and engine equipment, mechanical stokers throughout the plant and automatic scoops and coal carriers to bins that feed the mechanical stokers; also the erection of a concrete coal pocket and a tall smokestack to take the place of the present draft system.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 14 for an alternating-current electric distribution system and transformers, cables, motors and two feeder panels at the naval training station, Newport, R. I., at a cost of about $8,100. Plans and specifications can be obtained upon application to the bureau or to the commandant of the naval station named. H. R. Stanford is chief of bureau.

HARTFORD, CONN.—Plans have been prepared by the New York, New Haven & Hartford R. R. Co. for the building of a new transformer station to be erected on Spruce Street, to take the place of the old station on Laurel Street, in connection with the installation of new signals on the Shore Line division. As soon as the entire system of signals is completed energy for operating the system will be obtained from the main station at Cos Cob, and the service of the Hartford El. Lt. Co. will be discontinued at the local station, except for emergencies. The local station will be 12 ft. by 16 ft., one story, distributing three voltages, for the operation of signals, relays and track mechanism. Edward Gagel, of New Haven, is chief engineer.

Middle Atlantic

ENDICOTT, N. Y.—A large auxiliary power plant will be installed by Endicott, Johnson & Co., of Endicott, it is reported, in connection with their new tanning plant, to cost about $100,000. Orders have been placed for a 2500-kw turbo-generator, four 500-hp boilers, condenser, etc. Fred Firestone, of Rochester, electrical engineer, has charge of the work.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Feb. 24 for installing electric equipment in new Public School 115 on 176th and 177th streets. Blank forms, plans and specifications may be obtained at estimating room, ninth floor, Hall of Board of Education, Park Avenue and Fifty-ninth Street, New York.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, Army Building, New York, N. Y., until Feb. 25, for furnishing supplies under schedule No. 506 as follows: For 25 annunciators, 370 standard square outlet boxes, 9 main line switchboxes, 21 panelboard boxes, 21 standard distributing boards, 9 service distributing boards, 1450 conduit bushings, 16,000 ft. galvanized-iron conduit, 300 standard outlet box covers, 144 brass brush covers, 1102 galvanized condulets, 800 galvanized-iron elbows, 110 fuses, 21 electroliers, 375 sockets, 107 electroliers, 128 bracket fixtures, 110 lamp guards, 260 insulating joints, 1524 Fulman lock units, 21 Thompson meters, 42 Hubbell receptacles, 375 shades, 120 shades, 30 shades, 300 fixture studs, 130 switches, 15-lb. ceiling compound, 1625 pipe straps, 60 lb. friction tape and 32,000 ft. wire. For further information address Lt.-Col. M. Gray Zalinski, depot quartermaster.

NORWOOD, N. Y.—The Norwood El. Lt. & Pwr. Co. expects to purchase within the next six months one 350-kw, two-phase, 60-cycle generator and switchboard equipment for same. Cortes F. Vance is superintendent.

LOCK HAVEN, PA.—Bids will be received by J. Charles Schwamm, chairman of building committee, Lock Haven School District, Lock Haven, until March 10, for the erection of a school building, for which separate bids will be received as follows: For erection of building; heating and ventilating, plumbing, electric wiring, according to plans and specifications prepared by M. E. Joralemon, of Buffalo, N. Y., copies of which may be obtained upon deposit of $25, to be refunded upon return of same.

SHAMOKIN, PA.—The Borough Council has authorized the electric-light committee to secure estimates of the cost of the installation of a municipal electric-light plant. The present contract for street-lighting does not expire until 1917.

SUNBURY, PA.—The Northumberland County Gas & El. Co., of Sunbury, is contemplating extending its transmission line to McEwensville to furnish electrical service there. The company also proposes to erect a line to Pottsgrove, if sufficient patronage can be secured to justify the expense.

SPRING LAKE, N. J.—Bids will be received by the Mayor and Council of the borough of Spring Lake until Feb. 23 for furnishing 100 60-watt tungsten lamps and 25 100-watt tungsten lamps and necessary wiring for 25 lamp-posts; 10,000 ft. wood, fiber or tile conduit, with opening of from 2 in. to 3 in. Bidders are to submit samples and prices per foot. Also for 25 cast-iron ornamental lamp-posts for five-lamp clusters, with globes and sockets complete, not to cost more than $35 each. Bidders are to furnish their own plans and specifications for lamp-posts. Edward White is borough superintendent.

CHARLESTON, W. VA.—The Lackawanna Coal & Lumber Co., which owns a land acreage, is planning to begin extensive coal operations and contemplates building a model town in Boone County. The town will be known as Griffith, and 300 houses will be erected at once, equipped with running water, electricity and gas. The main office of the company is located in the Connell Building, Scranton, Pa.

RAVENSWOOD, W. VA.—An election will be held Feb. 21 to vote on the proposal to issue bonds for the installation of a water-works system and for improvements to the municipal electric-light plant. C. O. Nilsson is superintendent of the municipal light plant.

BUCHANAN, VA.—The Town Council has granted A. E. McCurdy a 30-year franchise to construct and operate an electric system in Buchanan. Mr. McCurdy expects to build a hydroelectric plant.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 26 for supplying to the various public buildings under the control of the Treasury Department portable vacuum cleaners during the fiscal year ending June 30, 1915. For further details see proposal columns. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 2, as follows: (1) For 125 miles of galvanized-iron, 81-mil wire as per drawing 106; (2) 100,000 ft. 45-mil twisted Monnet copper-clad outside distributing wire, as per specification 557; (3) 25,000 ft. 36-mil house wire, as per specification 340-3.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal office, War Department, Washington, D. C., until Feb. 28 under proposal No. 690 as follows: (1) for 50 jars (6 in. by 8 in.) for gravity battery; (2) 12,500 12-in. oak insulator brackets; (3) 17,500 double-groove, glass pony insulators; (4) 16 pole seats; (5) 100 10-amp type 2 fuses; (6) 150 15-amp type 3 fuses; (7) six Edison porcelain sockets; (8) 25 caps for hand receivers of CAT desk sets; (9) 10 3-bar generators for CAT telephones; (10) three 16-strip terminal boxes.

WASHINGTON, D. C.—Bids will be received at the office of general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 2, for furnishing electrical attachments and fixtures, electric wire, soldering sticks, wire clamps, pilers, galvanized wire, etc. Blank and general information relating to this circular (No. 829) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

WASHINGTON, D. C.—Bids will be received at the office of the general supply committee, Union Building, Washington, D. C., until March 19 for furnishing the executive departments and independent governmental establishments during the fiscal year 1915 with stationery and drafting supplies, hardware, metals, cordage and leather goods; leather and saddlery; drugs, medicines and chemicals; laboratory apparatus, hospital appliances and surgical instruments; electrical, engineering and plumbing supplies, etc.; incandescent electric lamps, incandescent gas lamp supplies, motor trucks, typewriting and computing machines. Blank forms of specifications and instructions will be sent to all manufacturers and dealers on present list and will be furnished to others upon application to the general supply committee. Byron R. Newton is acting Secretary of Treasury.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 10, for furnishing supplies at the various navy yards and naval stations as follows: Washington, D. C., Schedule 6428—four baskets for motor-driven centrifugals; Schedule 6420—miscellaneous cable for use on cranes. Brooklyn, N. Y., Schedule 6416—2500 lb. chloride calcium, in 50-lb. cans; Schedule 6413—40 seamless steel cylinders, 200 cu. ft. capacity; Schedule 6429—miscellaneous material for switchboard panels; Schedule 6419—750 ft. lead-covered, single-conductor cable; Schedule 6423—95,000 ft. double, flexible conductor for portables, 80,000 ft. double, flexible silk conductor. Philadelphia, Pa., Schedule 6426—miscellaneous lead-sheathed, paper-insulated cable, 450 ft. lead-sheathed, rubber-insulated cable. Boston, Mass., Schedule 6399—one electrically driven triple plunger pump. Bids will also be received until March 17, under Schedule 6430, for ten 1-hp electrically operated potato peelers, to be delivered at the Brooklyn Navy Yard. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, U. S. N.

North Central

BATTLE CREEK, MICH.—The city commission has authorized E. W. Arnold, architect, to prepare plans and specifications for an electric elevator, also for a hydraulic elevator for the new city hall for the purpose of asking for bids for same.

BRIGHTON, MICH.—The State Railroad Commission has granted the Brighton Lt. & Pwr. Co. permission to issue $16,000 in capital stock.

HIGHLAND PARK, MICH.—The village of Highland Park is contemplating the installation of a new water-works system. Electrically operated pumps will be used in the pumping station, which will soon be purchased. H. von Schon, Wayne County Bank Building, Detroit, is chief engineer.

IRON RIVER, MICH.—The Peninsular Pwr. Co., it is reported, is contemplating remodeling and enlarging its power house in Iron River, to cost about $100,000, during 1914. The work will include the erection of a new power house, installation of two new units, increasing the output of the auxiliary plant from 1000 hp to 3000 hp. The company is also adding two new units to its plant at Twin Falls. L. T. Sterling is assistant secretary.

SAGINAW, MICH.—The Germania Society has appointed a committee to make investigations as to the feasibility of installing an electric-lighting plant in its building.

WYANDOTTE, MICH.—The city commission is contemplating calling an election to submit the proposal to issue $40,000 in bonds to enlarge the municipal electric-light plant. The present plans provide for the erection of an addition to the power house at the foot of Vine Street, to be used as a boiler room, the installation of new boilers and a 500-kw or 600-kw generator, if the bond issue carries. Charles Garner is commissioner of municipal service.

AKRON, OHIO.—Plans are under way for increasing the output of the power plant of the Quaker Oats Co. It is proposed to build a new building near the present plant on Canal Street, to install two new boilers and erect a large smoke stack. J. H. Andrews is superintendent of the company.

CANTON, OHIO.—O. C. Barber, of Barberton, has announced that he proposes to establish an electric light and power plant in Canton.

CLEVELAND, OHIO.—The City Council committee has approved expenditures of approximately $500,000 by the Cleveland Ry. Co., to be used for extensions and improvements as follows: To purchase 50 center-entrance motor cars, $180,000; for motor equipment, $94,000; construction work at new repair shops, $135,000; for pneumatic door-operating mechanism, $50,000, and $10,000 for derrick car.

DAYTON, OHIO.—The Dayton Pwr. & Lt. Co. has applied to the Public Utilities Commission for permission to issue $604,650 in stock, to be sold at not less than 80. The proceeds of $245,200 are to be used for flood damage repairs and the remainder for extensions and improvements.

FREMONT, OHIO.—The street-lighting committee of the City Council, it is reported, has practically decided to relocate a number of street lamps and to add many more lamps to the street-lighting system.

GREENVILLE, OHIO.—The stockholders of the Greenville El. Lt. & Pwr. Co. have voted to increase the capital stock of the company by $40,000, the proceeds to be used to make improvements and for further extensions of its transmission lines.

McARTHUR, OHIO.—The McArthur Brick Co. is reported to have decided to erect a power house separate from the present machinery building and to install two additional boilers, one 300-hp engine and generator.

URBANA, OHIO.—The Urbana Lt. Co. is planning to extend its transmission lines to the Big Four R. R. gravel pit, between Catawba Station and Mechanicsburg (a distance of about 12 miles), where it will furnish 250 hp to operate motors. The company, it is said, has placed a contract for a steam turbine. The company will also furnish electricity in Mutual and to residences along the line. W. J. Hurd is manager.

WAUSEON, OHIO.—The local electric-light plant, owned by H. H. Williams & Co., of Wauseon, has been purchased by interests connected with the Toledo & Indiana R. R. Co., of Toledo. It is expected that the plant will be dismantled and electricity for operating the local system will be obtained from a central plant at Stryker.

CENTRAL CITY, KY.—The Central City, Greenville & Drakesboro Trac. Co., recently incorporated to build an electric railway between Central City and Greenville and Central City and Drakesboro, for which surveys have been made, also contemplates the construction of a central steam-driven electric plant on Green River, 2 miles from Central City. The plant will be situated in a mining district and will use waste coal for fuel. In addition to supplying electricity for operating the railway and for lighting the towns in the district, it will furnish electricity for operating machinery in the coal mines and other plants within a radius of 50 miles, and also build steel coal tipple and additional concrete coal pockets. Work will begin about May 1. The cost of electric plant and transmission lines is estimated at about $3,000,000. The company has been granted a franchise to operate an electric railway in Central City. W. H. Netherland, of Louisville, Ky., is in charge of the work. The incorporators are S. J. Gish, James Small, of Central City; T. C. Du Pont, Daniel Caufield, Wilmington, Del.; Hubert Meredith, Greenville, Ky., and L. L. Dunham, New York, N. Y.

FULTON, KY.—Mayor Homer Swann is negotiating with the Fulton El. Lt. & Pwr. Co. for furnishing street-lighting service in South Fulton.

GATLIFF, KY.—The Gatliff Coal Co., it is reported, contemplates the installation of an electric-lighting system for its coal-mining camps.

LEXINGTON, KY.—The Board of City Commissioners is considering plans for the installation of an ornamental street-lighting system.

BEDFORD, IND.—The Southern Indiana Pwr. Co., of Bedford, is contemplating extending its transmission lines from Bloomington to Ellettsville.

HANOVER, IND.—A company, it is reported, is being organized under the name of the Hanover Ltg. Co. to install a street-lighting system here. Electricity for operating the system will be obtained from the Madison Lt. & Ry. Co., of Madison.

BYRON, ILL.—G. W. Petit, Jr., of Byron, who has applied for a franchise here, does not contemplate the construction of a power plant, but will purchase energy from an outside source. If granted a franchise, he expects to purchase material for a distribution system, including poles, weather-proof wire, line construction material, substation equipment, transformers, three-phase meters and single-phase meters and all inside wiring material, including fixtures, utensils, motors, etc.

CHICAGO, ILL.—A committee, consisting of Aldermen Harding, Holding and Wilson, has been appointed to negotiate with the Sanitary District of Chicago for the installation of 5000 arc lamps and maintenance of same.

CHICAGO, ILL.—Arrangements have been made by the Oakland Business Men's Association for illuminating with arc lamps (similar to those on Dearborn Street) Cottage Grove Avenue and East Thirty-ninth Street, several blocks in each direction from their intersection, covering a circuit of about 15 blocks. J. M. Omo is president of the association.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Ill., at Room 406, City Hall, until Feb. 26, to design, construct and erect on monorail track provided by the city four 4½-ton monorail cranes, suitable for a maximum lift of 48 ft., and the dumping of the city's standard garbage boxes, to be operated by electricity (220-volt direct current); two multiple flexible arm crushers, each of sufficient capacity to crush 25 tons of garbage per hour to a size that will pass through a 1-in. circular mesh or a ⅝-in. bar screen; two 200-kw motor-generator sets, to operate under 60-cycle, three-phase, 440-volt alternating current and deliver 220-volt direct current; to construct and deliver steel girders and crane runway for monorail crane system; one set of alternating-current motors for driving crushers, picker belts and conveyors; for construction and erection on foundations provided by the city of two direct-indirect revolving driers, each having a capacity of not less than 100 tons of garbage containing not more than 80 per cent moisture, to a moisture content not exceeding 12 per cent when operating continuously during 24 hours; to furnish and install on foundation provided by the city a 30-in. apron conveyor in receiving building at the municipal reduction plant at Thirty-ninth and Iron Streets. Proposals must be made out upon blanks furnished at the above office, where plans and specifications are on file. George B. Young is commissioner of health.

MARINE, ILL.—The Marine Lt., Ice & Coal Co. is installing an electric-light plant here. Charles J. Crump is secretary and manager.

PRINCEVILLE, ILL.—Bids will be received by F. W. Cutter, village clerk, until Feb. 24, for construction of waterworks system as follows: (A) For an elevated tank of 50,000 capacity, 110 ft. to the top, including foundations, steel tower with steel or wood tank; (B) a motor-driven or belt-driven deep-well pump, of double-acting type (no air lift considered); a motor-driven or belt-driven two-stage centrifugal pump of 500 gal. per minute capacity; a gasoline or oil engine of sufficient capacity and equipped to operate either of the pumps; all to be furnished and erected on foundations; (C) a concrete underground storage reservoir of 50,000 gal. capacity. Plans and specifications are on file in the office of the village clerk, Princeville, and copies may be secured of the W. S. Shields Co., Hartford Building, Chicago, Ill.

RUSHVILLE, ILL.—A committee, consisting of Aldermen Keeling, Hodgson and Purcell, has been appointed to make investigations relative to the installation of a municipal electric-light plant.

DODGEVILLE, WIS.—The Wisconsin Railroad Commission has instructed the Dodgeville El. Lt. & Pwr. Co. to overhaul its plant thoroughly. The commission authorizes the company to engage an engineer to prepare plans and specifications, and says that the work must be completed within six months.

MINERAL POINT, WIS.—The Mineral Point Pub. Ser. Co. has been granted permission by the Wisconsin Railroad Commission to issue $200,000 in bonds, the proceeds to be used to pay off existing indebtedness, etc., and for extensions and improvements to its property. The company contemplates the extension of its high-tension transmission lines to reach certain mines in the vicinity of Mineral Point.

CANTON, MINN.—The Root River Pwr. Co., it is reported, is contemplating furnishing electricity in Canton and may extend its transmission line from Harmony.

KENYON, MINN.—Plans are being considered by the business men of Kenyon to form a company to operate an electric plant here. If the project is carried through, electricity for operating the system will be obtained from the plant of the Consumers' Pwr. Co. in Wanamingo.

ST. PAUL, MINN.—Bids will be received by the board of library directors of the city of St. Paul, Public Library, St. Paul, until March 10, for furnishing material required in the erection of the superstructure of the new public library building for the city of St. Paul and for furnishing and installing mechanical equipment for same as follows: (1) heating and ventilation, (2) plumbing and sanitation, (3) vacuum cleaning system, (4) elevators and dumb-waiters, (5) electrical construction. Plans and specifications for both superstructure and various branches of the mechanical equipment can be obtained at the office of the commissioner of public works, St. Paul, or at the office of Electus D. Litchfield, architect, 477 Fifth Avenue, New York, N. Y., for which a deposit of $10 will be required for superstructure, $3 for electrical construction and $4.80 for plans covering heating, ventilation, plumbing, vacuum cleaning and elevators. Separate proposals must be submitted for each item. F. A. Fogg is chairman of special committee on new building.

IOWA FALLS, IA.—Application has been made to the City Council by F. J. Cross, of Cedar Rapids, and associates for a franchise to operate an electric-light plant in Iowa Falls. If granted a franchise, they will either purchase the local plant or build an entirely new plant.

LOHRVILLE, IA.—The Town Council has granted the Calhoun County Pub. Ser. Co., of Rockwell City, a franchise to furnish electricity to light the town; also for commercial and domestic purposes. W. H. Marple is clerk.

OTTUMWA, IA.—Bids will be received by the Board of Water Works Trustees of the city of Ottumwa until March 17 for the construction of two dams across the Des Moines River and furnishing the necessary machinery and equipment for a hydroelectric power plant. Plans and specifications may be obtained at the office of the Ottumwa water-works. Homer A. Brown is engineer and superintendent.

RICHLAND, IA.—The Council is considering a proposal submitted by R. L. Van Meter, vice-president and manager of the Sigourney El. Lt. Co., of Sigourney, relative to furnishing electricity in Richland.

WATERLOO, IA.—Application has been made to the City Council by J. G. Melson for a franchise to install and operate electric-lighting, gas and heating systems in Muscatine.

WAUCOMA, IA.—The City Council has taken a 60-day option on a dam site together with water rights. Arrangements have been made to call a special election to vote on a $12,000 bond issue, the proceeds to be used to purchase the property covered by the option, to construct a new dam and erect an electric plant.

JEFFERSON CITY, MO.—At an election held Feb. 5 the proposal to issue $150,000 in bonds to establish a municipal electric-light plant in Jefferson City was defeated.

PATTONSBURG, MO.—The Commercial Club, it is reported, is promoting the installation of a municipal electric-light plant and water-works system.

NEW ROCKFORD, N. D.—The local electric-light company has been reorganized under the name of the Consumers' General Ser. Co. The new corporation owns and operates both the water and light systems. F. E. Corson, of Fargo, N. D., is president of the company.

ARLINGTON, S. D.—Within the next six months the city of Arlington expects to purchase one 75-hp or 80-hp oil engine, one 40-kw generator and one booster set for the municipal electric-light plant. R. W. Nash is superintendent.

ELK POINT, S. D.—The City Council has engaged Earle D. Jackson, consulting engineer, Capital Bank Bldg., Minneapolis, Minn., to prepare plans for the proposed municipal electric-light plant. An election will soon be held to submit the proposal to issue $25,000 in bonds for establishing the plant.

EUREKA, S. D.—Within the next 30 days the Aberdeen Engineering Co., of Eureka, expects to change its producer-gas engines to operate on kerosene oil. Fairbanks, Morse & Co.'s engines are used. David W. Lewis is chief engineer.

LAKE PRESTON, S. D.—Within the next 11 months the Lake Preston Milling Co. expects to expend about $500 for incandescent lamps.

MILBANK, S. D.—The Milbank Lt. & Pwr. Co. expects to purchase a voltage regulator. E. S. Schreiner is manager.

VERMILION, S. D.—Within the next three months the Vermilion Milling & El. Co. expects to purchase a 37½-kw gas-engine-driven generating unit (three-phase, 60 cycles) to parallel the present steam-driven units. M. E. Brookman is interested in the company.

WATERTOWN, S. D.—Within the next five months the Watertown Lt. & Pwr. Co. expects to purchase one or two carloads of 30-ft. (7-in.-top) poles. Clement H. Bell is superintendent.

WEBSTER, S. D.—The electric light commissioners expect to purchase within

the next three months 24 ornamental lamp standards for five-lamp clusters. George E. Boyle is superintendent.

STAPLEHURST, NEB.—Within the next 12 months E. Jacobs, owner of the local electric-light plant, expects to purchase a street-lighting switch; also house-wiring supplies, lamps, etc.

GARDEN CITY, KAN.—The Garden City Sugar & Land Co. is erecting a new power house at its sugar factory in Garden City, which will be equipped with a 2500-kw, 2300-volt Allis-Chalmers turbo-generating unit; one 22½-kw motor-driven exciter and surface condenser, complete with a 75-hp motor-driven circulating pump; one General Electric combination generator and feeder switchboard panel; one double exciter panel and brackets; three 667-kva, single-phase, 60-cycle, 33,000/2300-volt transformers; three 25-kva, single-phase, 60-cycle, 2300/460-volt transformers; one 5-kva, single-phase, 60-cycle, 2300/110-volt transformer for power house; for Farmers substation, three 200-kva, single-phase, 60-cycle, 33,000/4000-volt transformers, outdoor type; for Deerfield substation, three 200-kva, single-phase, 60-cycle, 33,000/6600-volt outdoor-type transformers; for deep-well substations, one 150-kva, one 125-kva, three 100-kva and one 75-kva, three-phase, 60-cycle, 33,000-volt/460-volt outdoor-type transformers; for shallow-well pump station, three 7½-kva, single-phase, 60-cycle, 2300/4000/460-volt transformer, outdoor type, all General Electric equipment. The company has also placed contracts for deep-well pumps and motors for same and for material for transmission and distribution lines. The company has one 150-hp, 600-r.p.m, 400-volt motor and three 100-hp, 600-r.p.m motors. These units will be used to demonstrate the requirements at each station by generating the necessary energy for one pump at a time at the Deerfield plant and transmitting over the new line, which is complete from Deerfield to the deep-well substations (excepting the high-voltage outdoor substation equipment). When this test (which will begin immediately) is completed the company will be in a position to order the remaining motors and transformers necessary, also deep-well pumps, if there be any with greater efficiency than the ones which it now has. The plant when completed will have an output of 2500 kw and will furnish electricity to operate 12 deep-well stations, Deerfield substation and Farmers substation, 1200-kw, 600 kw and 600 kw respectively. The main transmission line connecting Deerfield substation is 20¼ miles long; the lateral lines connecting the deep-well stations are 3¾ miles in length, making a total of 25 miles. Energy is transmitted at 33,000 volts. The Deerfield substation is the old South Side pumping plant and will now be used for stepping energy down to 6600 volts the same as was generated and transmitted in the past. This will leave the old line intact, and to it there will be added seven more shallow-well pumping stations, increasing the laterals on this line to 11 miles and making a total of 23½ miles of 6600-volt line. The company expects to purchase line construction material, transformers and polyphase wattmeters for the Farmers substation distribution lines at 4000 volts. The length of this line is not definitely decided upon: 10 or 15 miles will cover the present installation, with probably an ultimate installation of 30 miles. Further extensions are contemplated to its 33,000-volt line, but as yet nothing definite has been decided upon. W. H. Baird, of Garden City, is general manager, and H. H. Emery is electrical engineer.

LEAVENWORTH, KAN.—Bids will be received at the office of the superintendent of prisons, Department of Justice, Washington, D. C., until March 2, for furnishing and delivering at the United States Penitentiary at Leavenworth elevator equipment for hospital building, United States Penitentiary at Leavenworth, in accordance with plans and specifications, copies of which may be obtained upon application to the above office. F. H. Duehay is superintendent of prisons.

Southern States

BOONE, N. C.—We are informed that Messrs. Hartzog & Moretz, of Boone, do not contemplate the installation of an electric system at present. Reported in previous issue to be considering the installation of a generator to supply electricity for the town.

CHARLOTTE, N. C.—Contracts have been awarded, it is reported, by the Southern Pwr. Co., of Charlotte, for construction of dam and power plant at Lookout Shoals on the Catawba River, involving an expenditure of about $1,000,000, as follows: To the Hardway Construction Co., of Columbus, Ga., for building dam and power house, and to the Parker-Brooks Construction Co., of Macon, Ga., for construction of 5 miles of railroad from the Southern Railway to the site of the proposed development. The present plans provide for the development of 26,400 electrical hp and include the installation of four 6600-hp units and two exciter units. A fall of 74 ft. will be secured.

MONROE, N. C.—Within the next four months the electric light commissioners expect to purchase one carload of juniper poles. W. H. Crow is superintendent of the water and light plant.

ST. PAUL'S, N. C.—Within the next 10 days the St. Paul's Lt. & Power Co. expects to purchase one transformer. The company has just completed the improvements to its plant, costing $2,661.

SENECA, S. C.—Within the next few months the electric light commissioners expect to purchase one 6-kw, 125-volt exciter. Charles Floyd is superintendent.

NEWBORN, GA.—The local electric-light plant, owned by Dr. L. J. Pharr and J. L. Harwell, of Newborn, was recently destroyed by fire.

GORDONSVILLE, TENN.—The Gordonsville El. Lt. & Pwr. Co., it is reported, is preparing plans for the construction of an electric plant to develop 50 kw and the erection of a transmission line 1¼ miles long. Robert Harvey is engineer in charge and F. A. Smith manager.

NASHVILLE, TENN.—Plans have been approved by the board of city commissioners for doubling the output of the municipal electric-light plant, which will enable the Light Department to furnish electricity for commercial purposes. It is proposed to install an additional turbo-generating unit, at a cost of about $35,000.

EUFAULA, ALA.—In order to improve the lighting service new transformers will soon be installed in the municipal electric-light plant.

LITTLE ROCK, ARK.—Bids will be received by the State Capitol Commission until March 3 for the erection of a power plant to heat the State Capitol. The work will include the construction of a building 60 ft. by 90 ft., of concrete and brick; smokestack, 125 ft. high; installation of four 150-hp boilers, pipes from plant to be placed in tunnel 5 ft. by 7 ft. and 650 ft. long. Electric generators will be installed to furnish electricity for lighting the building when the Legislature makes an appropriation.

MINERAL SPRINGS, ARK.—The installation of an electric-light plant is under consideration. E. K. Walden is city attorney.

BOGALUSA, LA.—Plans are being considered, it is reported, by the Southern Lumber Co. for extending its light and water system to Columbia Road, Pleasant Hill and Richardstown.

NACODOCHES, LA.—The Nacodoches Lt. & Pwr. Co. expects to erect within the next 12 months 5 miles of transmission line and to install one 200-kva, 2200-volt, 60-cycle generating unit (directly connected); also to purchase one 150-hp boiler, one 15-kw, 125-volt motor-driven exciter, poles, lightning arresters, posts and electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. D. L. Thomas is secretary and treasurer.

AFTON, OKLA.—Within the next three months the water and light commission expects to purchase two 15-kw single-phase transformers, two single motors and meters. W. E. Blackwell is superintendent.

BENNINGTON, OKLA.—J. F. McMillen, engineer, of Hugo, Okla., it is stated, has been engaged by the Bennington Ice, Lt. & Pwr. Co. to take charge of construction of an electric-light plant. The plans provide for a 60-kw, 2200-volt alternating-current plant, to cost about $5,000. Bids for construction have already been received.

BRISTOW, OKLA.—Application has been made to the City Council for a franchise to construct and operate an electric-light plant in Bristow.

DUSTIN, OKLA.—The electric plant of the Dustin Lt. & Pwr. Co. was recently destroyed by fire.

HUNTINGTON, OKLA.—Application has been made to the City Council by Messrs. Memminger, McRae, Woods and Pinch, of Lakeland, for a 30-year franchise to construct and operate an electric-light plant and water-works system here. Huntington hat not a post office.

NORMAN, OKLA.—The Norman Tel. Co. will build a new central plant and install a complete central energy system during the next six months. The heavier cables will be placed underground. Dwight & Bozell, of Norman, are engineers for the company.

ABILENE, TEX.—The Central West Texas Irrigation Association is considering the question of erecting transmission lines to the territory around Abilene to furnish electricity to operate pumps for irrigation purposes and farming machinery. Electricity would be secured from the power plant of the Abilene Gas & El. Co.

BAY CITY, TEX.—The Texas Public Ser. Co., of Bay City, is planning improvements and extensions to its plant, including the construction of a complete new boiler room, two concrete ice vaults, new pumps and accessories; also increasing the boiler capacity from 125 hp to 250 hp and adding two panels to switchboard. W. C. Duncan, of Bay City, is manager.

BRYAN, TEX.—The Bryan Commercial Club is promoting a project to erect a municipal power plant, to cost $30,000, to supply electricity for street-lighting and to operate the Bryan-College Station interurban railway, which it is proposed to equip for electrical operation.

CLARKSVILLE, TEX.—The Clarksville Lt. Co. expects to increase the output of its ice plant to 30 tons and contemplates general improvements to the entire plant within the next six months. A. D. Simpson is secretary.

DECATUR, TEX.—The city of Decatur expects to extend the distribution lines of the municipal electric-light system 1½ miles; also to purchase one carload of white cedar poles and No. 8 wire. T. J. Crawford is superintendent.

DENISON, TEX.—The Texas Pwr. & Lt. Co., of Dallas, it is reported, has announced that it will erect a large power plant near Denison, but on the Oklahoma side of the Red River. It is planned to have the plant in operation early in 1916. J. F. Strickland, of Dallas, is president.

GAINESVILLE, TEX.—The City Council has contracted for additional arc lamps on California Street at every street intersection and for two 80-cp lamps on every block in the residence section. The Texas Pwr. & Lt. Co. furnishes electrical service in the city.

HUBBARD CITY, TEX.—Within the next two months the Union Central Lt. & Ice Co., of Hubbard City, expects to install a new street-lighting system for the city and to purchase auxiliary and switching equipment: also poles, distribution cable and wire, meters, tungsten lamps, posts, etc. W. A. Bass is president.

NEWTON, TEX.—Plans are being considered by H. T. Howard for the installation of an electric-light plant in Howard.

Pacific States

BELLINGHAM, WASH.—Investigations are being made by the city officials with a view of establishing a municipal electric-light plant here.

BELLINGHAM, WASH.—Arrangements are being made by the Bloedel-Donoval Mills Co., of Bellingham, to equip its lumber mills with electrically operated machinery, at a cost of about $60,000. Contracts for the equipment will be awarded during this month. J. H. Bloedel is president.

CASHMERE, WASH.—The Cashmere Wtr. Pwr. Co. is contemplating the construction of a combination dam at Sandstone Point below Tibbitts, to develop about 2500 hp. Five concrete piers will be built with four gates 21 ft. wide, operated by electricity.

MAGAZINE, WASH.—The City Council has granted the Magazine El. Co. a 20-year franchise to construct and operate an electric-light plant here. Construction work will begin immediately.

SEATTLE, WASH.—The Western Mills Co., of Seattle, recently incorporated with a capital stock of $10,000,000, will at once begin developments in the Puget Sound country. A large plant will be erected, for which site is now being selected, which will include the manufacture of lumber and by-products on a very large scale. A chemical laboratory will be erected on the site. A power development will be undertaken and a hydraulic system installed. U. K. Loose, of Seattle, is president of the company.

SEATTLE, WASH.—The Commissioners of King County have granted the city of Seattle a franchise to furnish electricity for lamps and motors in the district south of the city. This is the same territory in which the Puget Sound Trac., Lt. & Pwr. Co. was granted like privilege some time ago. Both franchises are for a period of 50 years. Each will stand an equal share of the cost of erecting poles. Fifty additions, all country roads, and five streets

lying in the south district and the Lake Forest Park district will be occupied by both.

TACOMA, WASH.—Property owners residing in the two North End residence districts and on Eleventh Street from C to K Street have petitioned Nicholas Lawson, commissioner of light and water, for the installation of a luminous arc-lamp lighting system in that section of the city. Plans are being prepared by E. W. Collins, superintendent of electrical works, for the North End district lighting, and these, when completed, will be placed before the Council.

TACOMA, WASH.—The Secretary of Agriculture has issued a water-power permit to the Washington Ry. & El. Co., of Tacoma, giving it permission to occupy and utilize lands within the Snoqualmie National Forest to develop hydroelectric power. The site is on the Sultan River, and the project includes the erection of nine dams, water conduits and power houses. The present plans provide for the development of 32,000 hp and the erection of a high-tension transmission line (55 miles long) to transmit energy to Everett, Wash., the nearest market available.

ASHLAND, ORE.—The city of Ashland is considering the construction of a new power house and installation of a 300-kw generator directly connected to a 500-hp waterwheel. A bond issue is contemplated, but nothing definite has yet been decided upon. H. G. Butterfield is superintendent.

EUGENE, ORE.—Bids are being received by the Oregon Pwr. Co. for electrically driven conveyor machinery, to be installed in a new storage plant being erected in Springfield, Ore. The mechanical equipment will be driven by individual motors. The cost is estimated at about $5,000. The closing date for receiving bids has not been announced.

NEWPORT, ORE.—The Yaquina El. Co., of Newport, expects to purchase within the next 12 months transformers, wire and meters, incandescent lamps and electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc.

PRINEVILLE, ORE.—Within the next 12 months the Des Chutes Pwr. Co., of Prineville, expects to erect a power plant on the Des Chutes River and to install a 150-kw generator (equipment purchased); also a 12-in. pump, which has been purchased. The company will also build a dam at its Crooked River power plant. L. M. Simpson, of Spokane, Wash., is manager.

BURNEY FALLS, CAL.—Notice of appropriation of 150 second-ft. of water on Burney Creek in Shasta County has been filed with the State Water Commission by the Pitt River Pwr. Co., of Burney Falls. The cost of the project is estimated at $75,000.

CORONA, CAL.—The Temescal Wtr. Co., of Corona, closed down its power plant at Ethenac Jan. 1 and now purchases electricity from the Southern Sierras Pwr. Co. H. R. Case is manager.

IMPERIAL, CAL.—At an election held recently the proposition to issue $40,000 in bonds for the installation of a municipal electric-light plant was defeated.

LOYALTON, CAL.—Application has been made to the Supervisors of Plumas County by R. B. Young for a franchise to erect electric transmission lines along the roads in Plumas County. Bids for the above franchise will be received until March 12. H. P. McBeth, of Quincy, is county clerk.

RIVERSIDE, CAL.—The Southern Sierras Pwr. Co., which is controlled by the Nevada-California Pwr. Co., Los Angeles, has filed with the State Water Commission notice of appropriation of 300 second-ft. of water on Baker Creek in Inyo County, the project to cost $550,000; also 300 second-ft. on Big Pine Creek in Inyo County, the project to cost $1,300,000.

RIVERSIDE, CAL.—The Coachella Valley Ice & Pwr. Co., with headquarters in Redlands, has applied for a franchise to erect a transmission line to connect with the Southern Sierras Pwr. Co. at Banning, the line to extend from Banning southeast to Imperial Junction and thence to Imperial County to furnish electricity for lamps and motors to the ranchers along the line. The cost of the line is estimated at $171,600.

SAN FRANCISCO, CAL.—The Ocean Shore R. R. Co., of San Francisco, has applied to the State Railroad Commission for permission to issue $200,000 in bonds for the purpose of equipping the railway for electrical operation from San Francisco to Halfmoon Bay, including substations, telephone lines and other appurtenances.

SAN RAFAEL, CAL.—The City Council has awarded the contract for the installation of the ornamental street-lighting system to the Pacific Fire Extinguisher Co., of San Francisco. The plans provide for the erection of 97 electroliers, for five-lamp clusters, manufactured by the Union Metal Mfg. Co., of Canton, Ohio, to be maintained by underground wires. The cost of the work is estimated at $14,165. Eugene W. Smith is city clerk.

WEAVERVILLE, CAL.—The Hardscrabble Mining Co. is contemplating improvements to its property, near Weaverville, which include the installation of an electric-power plant, stamp mill, machine drills and other equipment during the coming summer. The main office of the company is in Los Angeles, John Nefroney is general manager.

PROVO, UTAH.—Tentative plans, which provide for the installation of 50 arc lamps, have been submitted by the Utah Pwr. & Lt. Co. for improving the lighting system on the principal streets in Provo.

HELENA, MONT.—Plans are being considered for installing a street-lighting system on the west side of the town.

HELENA, MONT.—A special election will be held March 28 to vote upon the proposal to grant a franchise to the Standard El. Co., of Seattle, Wash. A. L. Goldschmidt is secretary.

COLORADO SPRINGS, COL.—Plans for the construction of a large power plant in the Cripple Creek district to supply electricity for lamps and motors for its own use and for other large consumers are under consideration by the Portland Gold Mining Co., of Colorado Springs. The cost of the proposed plant is estimated at from $200,000 to $250,000.

ARTESIA, N. M.—It is reported that the construction of an electric generating plant at the falls of the Penasco River, between Elk and Lower Penasco, is under consideration. The proposed plant will furnish electricity to operate the Cloudcrofty-Artesia interurban railway, being promoted by the General Electric Co., of Kansas City, Mo. The water-power is owned by Vernon L. Sullivan.

Canada

DUNCAN, B. C.—The civic authorities, it is stated, have decided to delay the establishment of the proposed hydroelectric plant at least for another year. An oil-engine reserve plant, probably of 200 kw, will be installed in the meantime, work on which will begin soon under the supervision of DuCane, Dutcher & Co., of Vancouver, consulting engineers for the city.

HEDLEY, B. C.—The Daly Reduction Co., of Hedley, will install a hydroelectric power plant in Hedley. The equipment will consist of a 1500-hp water turbine, one waterwheel governor, one 1250-kva generator with switchboard for same. Three miles of wire will be required for distributing system. George McEachern is engineer in charge.

KASLO, B. C.—The city is negotiating for the purchase of the electric-light and power plant, owned by the Kootenai El. Co. If the plant is taken over by the city the plant will be enlarged and improved.

KELOWNA, B. C.—Final surveys have been completed in connection with the Belgo-Canadian Land Company's hydroelectric project at Mission Creek, 15 miles from Kelowna, in the Okanogan Valley, work on which will begin in spring or early summer. It is proposed to develop 2000 hp at this point and transmit electricity into the city over the main transmission line at 13,000 volts. The company also proposes to furnish electricity in the adjoining districts as well as in Kelowna. DuCane, Dutcher & Co., Vancouver, B. C., are consulting engineers.

NORTH VANCOUVER, B. C.—Preparation of a by-law for the purchase of the lighting and power franchise from the Vancouver Lt. & Pwr. Co. has been authorized by the Municipal Council.

PRINCE RUPERT, B. C.—The Star El. Lt. & Pwr. Co., recently incorporated with a capital stock of $10,000, proposes to install an electric light and power plant in Prince Rupert. J. P. Puckett is manager.

VANCOUVER, B. C.—The Imperial Oil Co., 404 Abbott Street, Vancouver, has applied for water rights on Deer Lake for the purpose of developing a hydroelectric power plant there.

WINNIPEG, MAN.—The Winnipeg El. Ry. Co. has engaged the J. G. White Engineering Corpn., 43 Exchange Place, New York, N. Y., to complete surveys and prepare plans, etc., for the construction of a large hydroelectric generating plant near Winnipeg. The immediate plans for the new development provide for 40,000 hp, with an ultimate capacity of 100,000 hp. Sir William MacKenzie, of Toronto, is president of the company.

CORNWALL, ONT.—A by-law will soon be submitted to the ratepayers in regard to the project of the village contracting for energy from the Hydro-Electric Power Commission of Ontario. Electricity has been offered to the village at 26 per hp and the commission will install a pole-type transformer at Morrisburg to furnish the service.

HAMILTON, ONT.—The Hamilton Hydro-Electric Department has decided, it is reported, to adopt tungsten lamps for street-lighting in the underground conduit system in Hamilton. The cost of the tungsten lamps is estimated at $30,182 and that of arc lamps at $70,943, making the cost $38.78 and $54.12 respectively per lamp.

LONDON, ONT.—The London El. Co. will rebuild its present equipment in power station and install a new distribution system (2200 volts, 60 cycles, alternating current, and 250/500 volts, direct current). Reported in the issue of Jan. 31 to be contemplating an addition to its power house and equipment. Charles T. Barnes is manager.

TORONTO, ONT.—In addition to the Welland-Dundas-St. Thomas transmission lines, which are now under way, and the Dundas-Niagara Falls line, upon which work will be started soon, the Hydro-Electric Power Commission will engage in extensive construction work in the northern district to supply the towns within the reach of Eugenia Falls. The commission has approved the estimates of the chief engineer of the cost for which energy can be supplied to Flesherton, Dundalk, Hanover, Walkerton, Durham, Markdale, Chatsworth and Eugenia, which will be submitted to the municipalities as a basis for contracts. F. A. Gaby, chief engineer, has been authorized by the commission to secure the right-of-way between Niagara Falls and Dundas for the new transmission line. Investigations are being made by the Hydro-Electric Commission in Magnetawan with a view of developing water-power on the river there.

WESTON, ONT.—The Weston Electric Light and Water Works Commission has decided to make extensions of the electric service into Etobicoke Township, work on which will soon begin. The scheme is being financed by the Hydro-Electric Commission of Ontario, which will supply the material. The work will be done by the Weston commission.

Miscellaneous

TANANA, ALASKA.—Plans are being considered by the Tanana Gold Fields Co. to establish an electric plant near its properties in the Tanana gold field region to supply electricity for its properties and also to the Fairbanks district and vicinity. For further information address John L. Timmons, of Fairbanks, Alaska.

New Incorporations

WILMINGTON, DEL.—The Tri-City Automatic Home Tel. Co. has filed articles of incorporation with a capital stock of $1,500,000. The incorporators are W. G. Taylor, C. J. Jacobs and H. W. Davis, of Wilmington, Del.

HAILEY, IDAHO.—The Hailey El. Co. has been incorporated by Fred W. Gooding, of Shoshone; Frank R. Gooding, of Gooding, and John R. Hart, of Hailey. The company is capitalized at $45,000 and will take over what was formerly known as the Cramer light and power system.

ORLEANS, IND.—The Orleans El. Lt. & Pwr. Co. has been incorporated with a capital stock of $35,000 to operate an electric-light plant. The incorporators are E. M. Heise, of Orleans, P. Heise and H. P. Heise.

BANGOR, MAINE.—The Eastern Maine Pwr. & Devel. Co. has been incorporated with a capital stock of $200,000 to acquire and develop water-powers, etc. N. H. Hydorn is president and T. B. Towle treasurer, both of Bangor.

WATERTOWN, MINN.—The Crescent El. Co., of Watertown, has been incorporated by Guy E. Halgren, James J. Ponsford, Arthur C. Halgren, all of Watertown, and George E. Hanscom, of St. Cloud.

HARDIN, MONT.—The Hardin El. Lt. & Pwr. Co. has been incorporated with a capital stock of $30,000. The incorporators are E. A. Cornwall, Barney Blum and F. V. H. Collins, of Forsythe.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 10, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,086,347. CAPLET; R. B. Benjamin, Chicago, Ill. App. filed March 10, 1911. Porcelain cap secured to the end of a conduit for spreading the conductors leading therefrom.

1,086,350. RECEPTACLE AND CONDUCTOR FOR ELECTRIC LIGHTING; J. S. Crossley, Solvay, N. Y. App. filed April 17, 1907. Lamp sockets with clamping means for securing them to parallel wires.

1,086,396. ELECTRIC LOCOMOTIVE; G. F. Perin, Birmingham, Ala. App. filed May 15, 1911. Mining locomotive employing a cable reel.

1,086,414. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Electric zinc furnace with a bed of carbon resistor which is widest at its upper or reacting surface.

1,086,415. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Has overhead galleries through which charge is fed to portions of the upper face of the bed of carbon resistor.

1,086,416. ELECTRIC ZINC FURNACE WITH INTEGRAL COMPOUND RESISTORS AND COMPOUND CONDENSERS; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Rod resistor and a broken carbon resistor between which the charge is placed.

1,086,417. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed April 14, 1913. Has staggered stacks of vertically spaced plates constituting the condenser.

1,086,418. UNIVERSAL ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed May 8, 1913. Has a sump upon which carbon resistor is sustained and beneath which is the hot zone of a condensing system.

1,086,428. MANUFACTURE OF ELECTRIC FILAMENTS; C. A. von Welsbach, Vienna, Austria-Hungary. App. filed Aug. 9, 1898. Employs osmium and an oxide.

1,086,431. CONTROLLING DEVICE; P. H. Zimmer, Milwaukee, Wis. App. filed Aug. 3, 1911. For starting and accelerating motors.

1,086,437. DRY-CELL BATTERY; W. Broad, Beaver Falls, Pa. App. filed Sept. 17, 1912. Refillable cell with means for compressing the zinc element with the electrolyte to "boost" the voltage.

1,086,486. SELF-REGULATING DYNAMO-ELECTRIC MACHINE; C. A. Vandervell and A. H. Midgley, Acton Vale, England. App. filed Oct. 30, 1911. For use in train-lighting systems.

1,086,489. TREATING STEEL IN ELECTRIC FURNACES WITH BASIC HEARTHS; W. R. Walker, New York, N. Y. App. filed Dec. 14, 1912. Maintains the metal and a slag of lime and silica molten on a basic hearth in an electric furnace.

1,086,494. METALLURGICAL FURNACE; U. Wedge, Ardmore, Pa. App. filed May 11, 1911. Has electrical heating devices interposed in the flue between successive superposed treating chambers.

1,086,500. RAILWAY SWITCH OR THE LIKE; C. O. Anderson, Omaha, Neb. App. filed March 29, 1909. Motor turns a nut engaging a threaded shifting rod.

1,086,507. ELECTRIC SWITCH; B. L. Bronson, Blairsville, Pa. App. filed July 30, 1913. Push-button which may be used as a flush or countersink switch.

1,086,527. STREET INDICATOR FOR CARS; B. Hamilton and C. C. Timmons, Amarillo, Tex. App. filed March 16, 1910. Passenger on entering car pushes a key which indicates the street at which he wishes to alight, and when such street is reached motorman receives the signal.

1,086,537. MUSICAL ACCENTING DEVICE; J. F. Kelly, Pittsfield, Mass. App. filed June 19, 1911. The melody action is operated by a current whose force is greater than the force which operates the action in the accompaniment notes.

1,086,543. ELECTRIC-LAMP SOCKET; W. G. Lindemann, Milwaukee, Wis. App. filed June 2, 1913. Special form of interlock between the cap and shell.

1,086,559. FOLDING, PORTABLE ELECTRIC-LIGHT-BATH CABINET; C. F. Reuter, Oakland, Cal. App. filed March 5, 1913. Has a container wall into which the other walls fold.

1,086,565. SPARKING DEVICE FOR GAS ENGINES AND THE LIKE; J. E. Seeley, Los Angeles, Cal. App. filed July 12, 1905. Employs a condenser to get a high-frequency discharge.

1,086,578. ELECTRIC SWITCH; T. E. Barnum, Milwaukee, Wis. App. filed May 18, 1908. Switch which opens automatically under abnormal conditions irrespective of the condition of the controller handle.

1,086,579. ELECTROLYTIC WASHING AND BLEACHING DEVICE; E. Bess (deceased), Hamilton, Ohio. App. filed Aug. 8, 1912. Washing solution is subjected to the action of an electric current during the agitation of the clothes therein.

1,086,581. ANNUNCIATOR OR STATION INDICATOR FOR CARS; W. G. Billerman, Cleveland, Ohio. App. filed May 9, 1912. Automatically operated endless belt bearing station designations.

1,086,587. CONNECTING DEVICE; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed Jan. 6, 1913. Disconnectable plug and socket.

1,086,588. CONNECTING DEVICE; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed Jan. 6, 1913. Plug with contact-making plunger therein.

1,086,598. ROLLER TIMER; W. C. Kitchell, Ormond, Fla. App. filed March 3, 1913. Spring-pressed roller contact engaging rotary contact on the engine shaft.

1,086,599. ELECTRIC SWITCH DEVICE; C. J. Klein, Milwaukee, Wis. App. filed May 19, 1911. Concealed snap switch with push-buttons extending out through holes in a candle cup.

1,086,600. ELECTRIC SIGNAL FOR AUTOMOBILES; L. E. Landes, Los Angeles, Cal. App. filed Nov. 7, 1912. Rear signal of automobiles.

1,086,613. TROLLEY; J. Pfeiffer, P. Olah and A. G. Falkenstein, Salt Lake City, Utah. App. filed Feb. 21, 1912. Telescopic trolley pole automatically lowered when trolley leaves wire.

1,086,622. KNIFE SWITCH; C. Schuster, Bellevue, Pa. App. filed July 6, 1909. Employs a plurality of spaced thin, flat conductor bars to get greater ampere capacity.

1,086,623. CONDUCTOR POST; C. Schuster, Bellevue, Pa. App. filed Jan. 10, 1912. Spaced thin, flat conductors mounted in a surroundindg frame.

1,086,630. DISTRIBUTING BOX FOR ELECTRIC CONDUITS; C. E. Van Duzer, Cleveland, Ohio. App. filed Nov. 1, 1911. Cast-metal box having parts which may be interchanged for different varieties of connections.

1,086,639. SWITCH CONSTRUCTION; H. A. Benedict, Syracuse, N. Y. App. filed Nov. 22, 1912. Rotary snap switch with resistance element.

1,086,643. ELECTRIC-LIGHT SOCKET; W. Breidenbach, Indianapolis, Ind. App. filed Nov. 17, 1913. Has lock for securing the lamp in the socket.

1,086,646. HEATING APPARATUS FOR WATER BOTTLES; H. W. Christian, Long Beach, Cal. App. filed Sept. 16, 1913. Flexible electric heater which may be inserted in a flexible water bag.

1,086,661. ELECTRIC SWITCH; G. W. Goodridge, Bridgeport, Conn. App. filed Feb. 28, 1913. Key socket switch of double-break type.

1,086,666. STORAGE-BATTERY ELECTRODE AND PROCESS OF MAKING SAME; H. C. Hubbell, Newark, N. J. App. filed June 7, 1911. Storage-battery plate consisting of thin iron strips with intermediate layers of electolytically active iron oxygen compound.

1,086,693. ELECTRIC FUSE OR CUT-OUT; B. M. Walpole, Providence, R. I. App. filed April 12, 1912. Self-indicating fuse.

1,086,706. NORMAL-DANGER-SIGNAL SYSTEM; L. A. Hawkins and E. F. Bliss, Schenectady, N. Y. App. filed April 4, 1910. Has two line wires extending through each block in addition to the common wire.

1,086,710. ELECTRIC HAND-LAMP AND CASING; E. A. Hoopes, Des Moines, Ia. App. filed July 5, 1910. Storage-battery lamp with liquid seal vent for gas from the battery.

1,086,718. MASTER VIBRATOR; F. B. Johnson, Kansas City, Mo. App. filed Jan. 28, 1913. Has a switch simultaneously disconnecting the individual vibrator and introducing the master vibrator.

1,086,726. RESISTANCE UNIT; J. B. Opsahl, Madison, Wis. App. filed March 11, 1909. Inner and outer metallic terminals with an interposed non-metallic resistance powder.

1,086,729. ELECTRICAL CONTROL APPARATUS; J. R. Rey, Paris, France. App. filed Dec. 2, 1909. Ship's telegraph or light system for duplicating movements at a distance.

1,086,752. BLOCK-SIGNAL SYSTEM; J. Burke, Erie, Pa. App. filed June 28, 1911. For alternating-current propulsion system wherein the signal current is alternating but of different frequency.

1,086,759. APPARATUS FOR PRODUCING VACUUMS IN ELECTRIC LAMPS; L. A. Fell, Warren, Ohio. App. filed Jan. 2, 1913. To prevent entrance of the powdered phosphorus or other moisture-absorbing material into the bulb in case of accident.

1,086,797. ELECTRICALLY DRIVEN DRILL; W. F. Trotter, Charleston, W. Va. App. filed Dec. 31, 1907. Coal-mining drill in which the electrical parts are inclosed to prevent ignition of gas.

1,086,804. ELECTROLYTIC CELL FOR GENERATING HYDROGEN AND OXYGEN GASES; J. B. Burdett, Chicago, Ill. App. filed Oct. 28, 1913. Automatically circulates the electrolyte between the electro compartments and outer cell.

1,086,818. DYNAMO-ELECTRIC MACHINE; A. M. Gray, Milwaukee, Wis. App. filed Oct. 27, 1910. As guiding means for insuring discharge of the cooling fluid in a direction parallel to and away from axis of machine.

1,086,820. CONNECTOR; W. P. Hammond, New York, N. Y. App. filed Sept. 26, 1912. Cord terminal.

1,086,832. PORTABLE TELEPHONE SET; R. H. Manson, Elyria, Ohio. App. filed March 2, 1910. Straight bar with receiver in one end and transmitter in the other end and hinged deflector to send sound waves into transmitter.

1,086,864. RETAINING ENVELOPE OR COVER FOR STORAGE-BATTERY ELECTRODES; E. W. Smith, Philadelphia, Pa. App. filed July 7, 1911. Insulating tube with longitudinal ribs and circumferential crevices.

1,086,869. TELEPHONE SWITCHING APPARATUS; G. Swope, New Brunswick, N. J. App. filed April 14, 1911. Wall plate with push-button and a telephone plug adapted to be inserted in a wall plate.

1,086,870. COOKING APPLIANCE; A. L. Sykes, Covington, Ky. App. filed May 24, 1912. Electric stove converted into fireless cooker by capping the heating member with a heat-insulating casing.

1,086,874. LIGHTING FIXTURE; F. W. Wakefield, Vermilion, Ohio. App. filed Sept. 23, 1909. Chain links of suspended chandelier are faced with insulation to prevent grounding of the wires.

1,086,879. ICE-CLEARING TROLLEY; C. G. Woods, St. Louis, Mo. App. filed May 27, 1912. Ice-clearing wheel engages wire in advance of the trolley.

1,086,909. REFILLABLE FUSE TUBE; G. Fisher, Cleveland, Ohio. App. filed Feb. 10, 1913. Fuse wire gripped between metallic clamps on ends of removable insulation bar.

1,086,942. RELAY FOR STRENGTHENING WEAK ELECTRIC CURRENTS; J. Schiessler, Baden, Austria-Hungary. App. filed Sept. 20, 1911. An electromagnet damps the movements of the oscillatory member of a magnetic current.

1,086,985. ELECTRIC SWITCH; W. L. Bliss, Milwaukee, Wis. App. filed Sept. 6, 1907. Drop switch in which positive contact is made when switch arm drops and chattering is thereby avoided.

1,086,999. MAKE-AND-BREAK DEVICE; F. J. Devault, Denver, Col. App. filed Dec. 3, 1912. Particularly for register in connection with water or gas meter.

1,087,053. RAILWAY VEHICLE; N. W. Storer, Pittsburgh, Pa. App. filed April 4, 1906. Electric locomotive cab with separately inclosed end projections receiving the air compressors in blowers.

1,087,061. TABULATING MACHINE; H. Hollerith, Washington, D. C. App. filed April 1, 1912. Prevents one of a series of registers from being actuated by a second series of record cards until all the registers have been returned to zero.

1,087,078. AUTOMATIC WEIGHERS; C. L. Bond, Los Angeles, Cal. App. filed Oct. 28, 1909. Has settling mechanism for settling baking powder or like material into the can or container in which it is weighed.